Fachhochschule Dortmund
University of Applied Sciences and Arts

EURO MPM
European Master in Project Management

International Research Conference in Dortmund 2013

In 2010 we started the International Research Conference at the Dortmund University of Applied Sciences and Arts and continued this conference since 2010 every year.

The complete series of conferences is documented and has a face implemented as a wikispace http://internationalresearchdortmund.wikispaces.com/ .

The conferences were shaped mainly by contributions of students and staff of the Community of the European Master in Project Management – EuroMPM – from Dortmund, Bilbao, Latvia, and further countries. It is a place where master students and scientists find a forum for the presentation and discussion of the whole spectrum of activities within the EuroMPM. It is intended to set new directions for the EuroMPM and to find new areas for further research and teaching.

This year, the conference again spans over a wide range of topics. For example, the graduating master students presented a distinguished contribution on stakeholder analysis. From our former graduates we have a contribution from Sergio Kaufmann working on projects in Lybia – a very hard job but also a challenge after the revolution in that country – and several EuroMPM students are already working in internships with Sergio. From our German partner universities we have contributions of Jan Albrecht and Konrad Spang from Kassel. We have contributions of colleagues from Kaunas. This new partner will probably join the European Master in Project Management – they have a contribution on competence development in higher education. We have a new section on projects in the energy sector because we started to develop a new specialization in that area. This conference also contributes to the development of the home university – this year by starting a discussion on social responsibility and sustainability not only in projects, but also in the university.

This conference has its own spirit and power since the beginning in 2010.

In 2013 the conference has 4 sections:

1. **Project Management**

   Anna Petrakova: Analysis of project stakeholders with the help of the RASCI matrix

   Jan C. Albrecht, Konrad Spang: Challenges and Adoption of Application of Project Management Maturity Models

   Sergio Kaufmann: New Projects in Libya

   Frank Stumpe: New view on project and investment management in a more agile IT and agile Business Environment

2. **Energy Projects**

   Werner Wetekamp: Investment Projects in the Energy Sector - Bottleneck Financial Sources

   Tobias Aschoff: Tailoring of company internal project management standards for power plant projects

   Carsten Lau: Project Standards in Utility Sector

   Jan Schneider: Management of Organizational Change Projects in German Energy Sector

   Andre Dechange: Multi Project Management in the Utility Sector

3. **IT Projects**

   Marius Khan, Sabine Sachweh: Designing an AIS based communication infrastructure to enhance security and navigation in seafaring

   Aylin Celik, Immanuel Först, et al: System Level Design of a Viterbi Decoder with Mentor Vista

   Carsten Wolff: Shaping the information supply chain for M2M systems

4. **Project Management in Education**

   Jan-Philipp Büchler: Teaching with the Case Method

   Elena Vitkauskaite: Involvement of students in research project implementation: evidence from pilot action in Lithunia

   Beáta Vajda Kincsesné, Éva Málovics, Gergely Farkas: Experiences of competence development in higher education

   Peter Reusch: Responsibility and Sustainability in Projects

   Sigrid Michel: How to create a responsible and sustainable university?

We thank all authors for the contributions to the International Research Conference in Dortmund 2013. The contributions are important – but also the discussions – and the evolution of the community – and the growing power to meet the requirements of the future.

Greetings from the flow of strong projects

Peter Reusch and Carsten Wolff

Table of content

Analysis of project stakeholders with the help of RASCI Matrix (on the example of Project Management processes applied at Business Division Electronics at Hella KGaA Hueck&Co)

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Keywords: stakeholder management, responsibility assignment matrix, project manager, project core team member

Abstract: Stakeholder management is one of the most significant aspects on the way to successful project management. The process of stakeholder management differs from one project to another as every project creates unique outputs. According to **PMI (2013)**, a project is: "a temporary endeavour undertaken to create a unique product, service, or result". **[1]** All the projects have limited duration, therefore specific start and end dates. Another project constrain includes limited budget. A clearly defined scope used to be the third feature of the project. Thus, in order to deliver the product or service in time, within budget and scope constraints, satisfying quality requirements, a lot of participants or stakeholders are involved.

This article is providing an analysis of some features of it at Hella KGaA Hueck & Co. This is a global, independent, family-owned company with more than 27,000 employees at 70 locations in more than 30 countries. The Hella KGaA Hueck & Co develops and manufactures lighting and electronic components and systems for the automotive industry and also has one of the largest trade organizations for automotive parts, accessories, diagnosis and services throughout Europe.

There is a misunderstanding between the Project Manager and Core Team members concerning determination of their roles and responsibilities inside the projects at Business Division Electronics. The Business Division Electronics has sales of € 1.9 billion. The products for this division are being developed at 13 development sites and produced at 11 production sites.

The Hella KGaA Hueck & Co. is a project-oriented organization which has a continuously developing procedure of project management. Hence, there are plenty of tools which are aimed at analysis and satisfaction of stakeholder's needs. According to general project management practices, it is important to design a proper responsibility assignment matrix to avoid conflicts between the project participants.

This article contains an improved RASCI Matrix, which should be aimed at solving the arisen problem. It has two versions and contains all the information which doesn't exist in the project organization tools at Hella KGaA Hueck & Co. nowadays. It has the original structure, provided in many literature references. All the Project Core Team members are clearly determined there. The description of the RASCI Matrix can be used as a guide for the Project Managers, who will be using this tool.

1. Introduction

The process of stakeholder management differs from one project to another as every project creates unique outputs. Stakeholder management is an important issue in project management as a project can be seen as a temporary coalition of stakeholders having to create something together. **[2]** Hence, it is common knowledge that different kinds of conflicts can appear because of various reasons, e.g. misunderstandings of roles and responsibilities, differences in prioritizing tasks, lack of communication, depending tasks, distrust, interpersonal or intercultural issues, etc. In order to avoid appearance of conflicts because of unclear determination of roles and responsibilities, project manager can use different tools and instruments. One of them is Responsibility Assignment Matrix, also known as RACI Matrix.

This article is providing an example of using a kind of RACI Matrix to solve the problem of misunderstandings between the Project Manager and Core Team members at Business Division Electronics in Hella KGaA Hueck & Co.

2. Responsibility Assignment Matrix in projects

RAM, also known as a RACI-matrix, is used to illustrate the connections between work packages or activities and project team members. **[3]**

Different references give different definitions to such kind of matrixes. For instance, in PMBOK, RACI is one of the forms of Responsibility Assignment Matrix. Moreover, RAMs differ from each other depending on the project scale. For large projects it is reasonable to develop a high-level RAM. It can define what a project team group or unit is responsible for within each component of the WBS. **[3]** For other projects, the PMI recommends to make a matrix which is designated roles, responsibilities, and levels of authority only for specific activities.

On the figure below there is an example of RACI-Matrix. It is typically created with a vertical axis of tasks or deliverables, and a horizontal axis of roles.

RACI Chart	Person				
Activity	Ann	Ben	Carlos	Dina	Ed
Define	A	R	I	I	I
Design	I	A	R	C	C
Develop	I	A	R	C	C
Test	A	I	I	R	I

R = Responsible A = Accountable C = Consult I = Inform

Table 1. Responsibility Assignment Matrix using a RACI Format. **[3]**

Such matrixes are developed on the early stages of the project. Usually, the project team jointly completes the responsibility matrix by filling in the accountability levels of each role. **[4]** For example, a team decides to add a role of Software Engineer. After that all the tasks inside the matrix should be reviewed in order to fill a new role. At the end of this process, the Software Engineer should be accomplished to more than one role and have different levels of responsibilities inside the project. This process continues for all the roles on the project until the matrix is complete and at the end, the project team together signs and approves the responsibility matrix. **[4]** The tasks can be taken from Work Breakdown Structure and deliverables from a Product Breakdown Structure. Organizational chart used to be a source for different roles.

The responsibility assignment matrix used to be a very powerful tool which is important through all the processes in project stakeholder management. During identifying stakeholders, the project manager is developing the roles inside the project and connecting them with tasks. After that, all the team members should review their roles and responsibilities and agree or disagree with project manager's decision. Hence, during this stage discussions and conversations are possible in order to create a clear responsibility assignment matrix. Although, these processes could also be a part of planning stakeholder management. If the matrix satisfies the project manager's vision and stakeholder's expectations, then it will be an appropriate tool during managing and controlling stakeholder engagement. Here it has power to be a kind of guide for the project manager.

The responsibility matrix does not contain the actual status of the project and therefore does not require regular weekly reporting. It could be included in an automated scheduling system that the project is already using, and this would allow the simple updating of the matrix fields when adding new activities to the project, maintaining the ongoing currency of the responsibility matrix with minimum effort.

3. Implementation of RASCI Matrix to projects at Hella KGaA Hueck & Co.

The Hella KGaA Hueck & Co. defines five major roles inside the project. They are Group Manager, Project Sponsor, Project Manager, Project Core Team Member, Project Extended Team Member. The last two roles are used to be performed not by one person, but by the group of people. The processes of project life-cycle in the company are used to be adapted to the practice that Hella KGaA Hueck & Co. has. On the other hand, because of the continuously developed nature of projects, it is difficult to standardize these processes. Therefore, the problem that rose within some projects at Hella KGaA Hueck & Co. seems to have logical reasons. There is a misunderstanding between the Project Manager and the Core Team Members concerning determination of their roles and responsibilities inside the project. As this difficulty exists in the projects inside Business Division Electronics, the author of this article is focusing the attention on it. In order to solve the problem, it is important to analyse the existing project

organization tool at Hella KGaA Hueck & Co., then introduce a new instrument and provide a detailed description of its advantages, disadvantages and the process of implementation.
Hella KGaA Hueck & Co. already has a responsibility assignment matrix, which is used to structure work of Project Manager by containing a means to clarify tasks, responsibilities, and availability levels within a project. Moreover, its main aim is to ensure a systematic flow of information between all the participants. Here ***"D"*** stays for **"Decision"**. It means the person who is subscribed to this letter has to make decisions on the basis of recommendations of the person carrying out action. He/she is determining the starting point of the process, its depth and intensity. It is possible that some tasks don't contain this responsibility. On the other hand, it is impossible to order more than one person for this responsibility. Letter ***"E"*** means **"Execution"**. Participants, who are subscribed to it, are actively involved in the process. They also have to give recommendations to the participants, who have the responsibility of "Decision". If there is no defined person to make decision, this has to be done by the person, who is acting on the task. In order to achieve the target, he/she should ask other participants for support. In contrast to the first responsibility, here should be always somebody undertaking the actions. In case there are several people actively involved in the task, the decision responsibility should be clearly identified. The third letter here is ***"S"***, which suits the meaning **"Support"**. These participants should help those, who are taking actions. There is no limit defining the number of supportive participants. The provision of support also opens up the right to have a say. Thus the person providing support is the first control body of the person carrying out the action, with this control on the basis of a critical partnership. The last responsibility is focusing on participants who have to be **"Informed"**, therefore the letter ***"I"*** stays in the scheme. People, who are acting during the project, are informing these participants about the project' status and achievement of the important milestones. Different means could be used here depending on the agreement between the participants, e.g. e-mail, phone, fax, etc. Here are also no limits on number of people to be informed.
The DESI-scheme has a very simple structure. The determination of responsibilities is very logical: the connections between them are very clear that is adding value to the process. On the other hand, it has an unusual structure. Instead of dividing the responsibilities between stakeholders, it is illustrating to which kind of action which participant belongs to during performing a certain task. The second advantage of it is that it allows a user to see who exactly is involved in the defined task. Hence, one can make the easier calculation about the human resource costs of it. On the contrary, such kind of scheme does not allow easily seeing responsibilities of every one participant, besides the Manager of Production Line and the Project Manager, who used to have the same responsibilities throughout the whole project. Others cannot understand their input from the first sight. They need to look through each task individually to find out where exactly they are involved and in which form. This structure can possibly influence the raising of such misunderstandings between the Project Manager and the Core Team Members. Moreover, this scheme doesn't define where the Core Team Members should take the responsibility and where the project team member should be in charge. This is the second disadvantage of the DESI-Scheme. Another negative aspect of it is that there is no clear determination of the Core Team members. The scheme provides only one responsibility for the general term "Core Team members" in every task. It is impossible for these participants to find their roles and responsibilities. Moreover, according to the DESI-scheme, the Core Team members have only to be informed through the whole project life-cycle. This has to be the main reason of the appeared problem.
Taking in account this information and summarizing the general project management experience, the author of this research suggests using the RASCI Matrix.
Analyzing the present situation in some projects at Business Division Electronics and bearing in mind different kinds of responsibility assignment matrices, the following responsibilities for the RASCI Matrix were proposed:
Responsible *"R"* Its meaning is very close to the original one provided in many theoretical resources. It is the person who performs an activity or does the work. It is alike the meaning of "Execution" responsibility in the DESI-scheme. The difference is that it doesn't mean the person should give advices to the upper management team members. On the other hand, he/she is being supported and can ask for a consultation from other participants.
Approve *"A"* It is a person who is playing the crucial role in the decision-making process. Compared to the DESI-scheme, it has the same meaning as "Decision" responsibility. Only one person can be subscribed to approve the task. His/her role here includes also the output after completing the task. So he/she has a right to give a start to the next activity when the previous is being delivered successfully.
Support (like administrative) *"S"* These participants are performing the tasks together with person, responsible for their completion, but more in the administrative area. This role suits to the model Project Core Team Member and his Project Team Member. It means, for instance, if the Core Teamer – Test

Engineering (CT-TE) is responsible for the task, then his Project Team of Test Engineering (TE) is playing the supporting role.
Consulted *"C"* These participants need the feedback to contribute to the activity. The DESI-scheme doesn't contain such a responsibility. In the RASCI Matrix, these members used to have also the role of "Informed", but this is not happening in all the tasks.
Informed *"I"* The person, who needs to know about the decision. This responsibility also exists in the DESI-scheme.
The next point to be described here is devoted to the structure of the RASCI Matrix. The author suggests two versions of it: the full or detailed version and short version. Both of them have the original structure like in most theoretical resources. It means, the activities are named on the left side of the table and are situated vertically. Participants could be found on the upper side of the table in the horizontal way.

4. Results and Conclusion

In order to solve the problem of misunderstandings between the Project Manager and the Core Team members concerning determination of their roles and responsibilities inside the project, the author conducted an analysis of literature references and based on its results and Hella KGaA Hueck & Co. experience, the appropriate project instrument was designed.
RASCI Matrix, also known as a responsibility assignment matrix, is used to illustrate the connections between tasks, sub tasks and the project team members. It was designed taken in account the special features of projects at Business Division Electronics at Hella KGaA Hueck & Co. Therefore, it has two versions. Moreover, it contains all the information which doesn't exist in the project organization tools at Hella KGaA Hueck & Co. It has the original structure, provided in many literature references. All the Project Core Team members are clearly determined there, so it helps to solve the problem of misunderstandings between them and the Project Manager.
The description of the RASCI Matrix given above should be used as a guide for the Project Managers, who will be using this instrument. There is a need to implement the matrix as soon as possible in some certain projects in order to avoid escalation of conflicts. This instrument is designed according to the existing version Product Engineering Processes. But it will not lose its urgency even with appearing of new processes, as there are a lot of projects which will be using the present version of it during next years. Moreover, this matrix is easy to correct due to the actual needs of the company.
As this topic embraces a broad aspect of project organization, there is a room to research it in future. First of all, it is important to get the feedback on the new matrix from the Project Managers. Secondly, there is a need to make deep research on stakeholder management in terms of appearing new processes. The possible questions here are:

- How the roles are developed inside the projects?
- What is the management perception of roles inside the projects?
- How is it possible to define the roles in the project, applicable for the new processes?

Answering these question can help to find the solution for broader aspects in context of project management in general, e.g. what are the perspectives from implementation of defined tools and techniques for the future of project management.

5. References

[1] PMI (Project Management Institute), 2013, *The Standard for Project Management Fifth Edition*, Newtown Square, PA
[2] E.S. Andersen: Project management – an organisational perspective, *NKI Forlaget*, Bekkestua (2005)
[3] PMI (Project Management Institute), 2008, *The Standard for Project Management - Second Edition*, Newtown Square, PA
[4] Dow, B. PMP, Taylor, B. 2008, *Project Management Communication Bible*, Indianapolis
[5] Bryson, J.M. 2003, *What to do when stakeholder matter – a guide to stakeholder identification and analysis techniques*, Minneapolis
[6] Cabanillas, C. Resinas, M. Ruiz-Cortes, A. 2011, *Mixing RASCI Matrices and BPMN Together for Responsibility Management*, Sevilla, Spain
[7] Morgan, R. 2008, *How to do RACI charting and analysis – a practical guide*, Project Smart
[8] Kerzner, H. 2009, *Project Management – a system approach to planning, scheduling and controlling*, Hoboken, New Jersey

CHALLENGES IN ADOPTION AND APPLICATION OF PROJECT MANAGEMENT MATURITY MODELS
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TWO CASES FROM ENERGY SECTOR AND AUTOMOTIVE INDUSTRY

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Keywords: project management maturity models; standardization/ formalization of project management; energy sector; automotive industry

Extended abstract:

Introductory notions on project management maturity models

The trend of globalisation/ internationalisation has promoted competition, consolidation processes and both the number and quality of challenges industry companies are facing nowadays. Due to these developments, companies should strive for learning from past (project) business activity and improving their (project) management structures.
Project management maturity models (PMMM) provide a framework for a systematic process of organisational learning and improvement. They are designed to be used in terms of a cycle of (1) assessment, (2) analysis of the assessment and assignment of a maturity level, (3) formulation of improvement activities, (4) implementation of improvement activities and, finally, (5) re-assessment (cf. Figure 1).

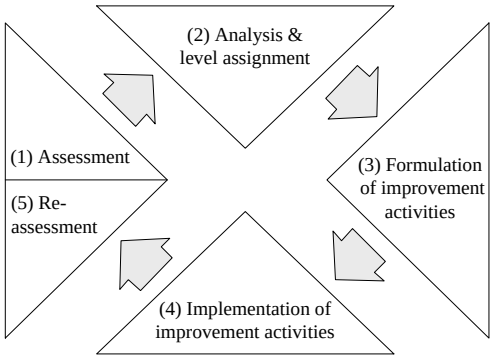

Figure 1: Cyclical application of project management maturity models [1]

The models mostly apply a step-like structure with e.g. five maturity levels. The lowest level then stands for informal project management structures. Organisations on this level mainly rely on the intuition and experience of their project managers and further project personnel. With higher levels of project management maturity comes the formalization of project management structures. This formalisation might be achieved through the implementation of a landscape of project management processes, as suggested in the systematic of the majority of the models. The processes shall then be standardised across the organisation, their effectiveness/efficiency be tested through application of quantitative metrics, and on the basis of this continuously

improved. Kerzner defines as follows: “Maturity in project management is the implementation of a standard methodology and accompanying processes such that there exists a high likelihood of repeated successes.” [2]
Proceeding from Kerzner’s definition, the benefits that accrue from a high level of project management maturity shall be outlined. Cooke-Davies subsumes the purposes for which an organisation might seek to use PMMM:

- “To understand what practices and processes have been consistently found to be useful by organizations seeking to undertake organizational project management
- To drive business improvement, for example, by understanding the key practices that need to be embedded within the organization to achieve the next level of maturity
- To assess its ability to implement its high-level strategic planning at the tactical level of managing individual projects and groups of projects
- To integrate organizational practices and processes in the domains of portfolio management, program management, and project management” [3]

The main premise underlying PMMM is that with an increasing maturity level of an organisation, the chances for successfully completing its projects also increase. [4] However, there is no empirical proof of this premise, hitherto. On the other hand, PMMM in general, their development process and their methodology have been frequently criticised. Subsequently, Grant and Pennypacker state: “One of the most important issues that future research should address is to establish a clear relationship between project management maturity and successful project delivery.” [5]

Introducing a research project and two case studies

A first working hypothesis of an ongoing research project is directly derived from the literature review in the field of PMMM and runs as follows:

> WH_1: There is a positive relationship between an organisation’s level of project management maturity and the success of its projects.

As every effort of an organisation to increase its maturity level will be connected to some (opportunity) cost, the question of a – company specific – “ideal” maturity level can be drawn. ‘Ideal’ hinting at the optimal ratio of costs and benefits of a certain maturity level in this context. While WH_1 might be subject to empirical testing, the question drawn in this paragraph requires qualitative exploration. On behalf of this, a number of case studies with organisational units of industry companies were conducted, with two of them presented in this article. Some demographic data and characteristics of the two cases can be retrieved from Table 1.

Table 1: Demographic data and characteristics of the two cases presented in this article

Characteristic/ Case Study	**A**	**B**
Industry	Energy sector	Automotive
Position in supply chain	Plant engineering company	Supplier
Unit of analysis	Organisational unit of a (larger) company	Organisational unit of a (larger) company
(Project) business	Investment projects; turnkey power plants	R&D projects; components of car’s drive-section
Scope of project product	Array	Assembly
Degree of technological uncertainty in projects	Medium-Tech	Medium-Tech

No. of employees (category)	≥ 250	≥ 250
Annual turnover (category)	> 50 Mio. €	> 50 Mio. €
Interviews conducted	2	2
Documents reviewed	Overall company's... ▪ PM handbook ▪ PM maturity model	Overall company's... ▪ PM standard ▪ PM handbook ▪ PM maturity model

In both cases the units of analysis are organisational units within larger companies. Case A constructs turnkey power plants for energy providers. Case B supplies car manufacturers with components of the car's drive-section. The interviewees belong to the following categories: Project managers, managers of a group of project managers, members of overall company's central units. However, all interviewees had experience in working in projects.
The two cases are herein analysed among the following lead questions:

a) Which models and other frameworks do they use in terms of organisational learning and improvement?
b) What are the main reasons for usage of maturity modelling?
c) Which maturity level do they head at and why?
d) What kind of problems do they face regarding the systematic of maturity models?
e) What is the opinion of the (operative) project personnel towards maturity modelling in general, the company's own approach and the formalization that comes with higher levels of maturity?

These questions shall help to better understand what influences the company-individual ideal level of project management maturity and, finally, lead to the formulation of a second working hypothesis, which also can be subject to quantitative testing.

Outline of findings

In both cases the larger companies applied their own PMMM, which (again in both cases) contained structural and contextual elements from CMMI[1] and PMBOK Guide[2]. The maturity models are used in order to implement a Continuous Improvement Process and to be able to measure to what extent the company-own project management structures (as documented in their project management standards/ handbooks) are applied and if they are correctly applied.
The acceptance of the approach of maturity modelling was reportedly good. The interviews reveal some evidence that the acceptance is given, due to the fact that both cases operate in rather complex project environments. The degree of internationality of the projects, the size of the project's scope, the degree of the project team's geographical dispersion, etc. were mentioned as facets of this complexity.
Yet, the interviewees also expressed some criticism, which – amongst others – covered on the following points:

- "Over-formalisation"
  effort connected to working in formal structures outweighs the benefits of formalisation/ standardisation
- "Hiding" behind formal structures
  staff works according to formal structures, but uses them to blind out e.g. severe project risks or to blame other project team members when risks did actually occur

[1] Capability Maturity Model Integration; process maturity model developed by the Software Engineering Institute (SEI) of Carnegie Melon University
[2] A Guide to the Project Management Body of Knowledge; developed by Project Management Institute (PMI)

- Maturity models lack “human factors”
  formal structures were seen as prerequisite for successful project completion in complex environment, but so were competencies of project manager and staff; interviewees criticised that PMMM do not cover on this “human side” of PM

In both cases the overall companies struggled to present a clear approach through which the ideal level of project management maturity for a certain project business environment could be determined. The qualitative data show that the project complexity might be of importance in this regard. This led to the formulation of the second working hypothesis.

WH_2: The degree of complexity of an organisation’s projects positively moderates the relationship between its project management maturity level and the success of its projects.

Both working hypotheses will be subject to empirical testing in a subsequent phase of the research project. In this phase quantitative data will be gathered from project managers and sub-project managers from industry companies through a questionnaire.

References

[1] Project Management Institute: Organizational project management maturity model (OPM3). 2nd Edition, PMI, p. 18, (2008)

[2] H. Kerzner: Project management. John Wiley and Sons, p. 58, (2009)

[3] T. Cooke-Davies: Project management maturity models. In: P. W. G. Morris and J. K. Morris, The Wiley guide to project organization & project management competencies. John Wiley and Sons, p. 304, (2007)

[4] F. Ahlemann; C. Schroeder; F. Teuteberg: Kompetenz- und Reifegradmodelle für das Projektmanagement. Eigenverlag, (2005)

[5] K. Grant; J. Pennypacker: Project management maturity: an assessment of project management capabilities among and between selected industries. IEEE Trans. Eng. Management, 53(1), pp. 59–68, (2006)

Making projects under the new situation of Libya

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Keywords: assessment, portfolio management, maturity, EPCM, PMO

Abstract: The situation in Libya is unique. After more than 40 years of dictatorship and after a revolution [1], now as a free nation and with considerable oil-based resources, it is time to rebuild the country. The main challenge is where and how to start. In this paper we identify the reality that companies are facing and also some recommendations regarding project management (PM) practices.

1. Introduction

The current situation in Libya is very special. Having lived more than 40 years under a dictatorship regime and having faced a revolution, during the past events which were part of the phenomenon called "Arab Spring" [2], now Libya's people want the country to be rebuilt.
The current situation is quite complex. For instance, there were a lot of projects under way when the revolution happened. Now, a lot of stopped projects can be seen in Tripoli, like a 5 star hotel with a shopping center, or some structures for airway access. And of course, there is still a lot of debris on the streets, demanding soon action.
Libya is a major oil producer, which means that money for projects will be available and is not part of the problem. The country's gross domestic product per capita, at current prices, is about USD 12,000, and its population is estimated in 6.6 MM inhabitants [3]. A curiosity: Petrol is cheaper than bottled water.

2. Current Situation of Project Management

In terms of PM, there are some state-owned companies which have considerable resources to undertake projects, such as companies related to the ministries of oil & gas, electricity, housing, and transport.

The maturity of these companies in terms of PM is normally low. This means people assigned to projects are often technically strong, considered expert in the engineering areas. Lack of PM practices is one of the common elements identified.

Another common point observed has to do with the owner-contractor approach. It is common to undertake turnkey projects, in which the contractor is supposed to deliver everything, with the solution designed, constructed and installed. But the reality shows that the results are not as expected in terms of time, cost, or quality. Consultancy in PM has a lot to do here.

3. Addressing the situation

There is so much to do, that to solve the high current demands of projects is urgent. To have a reasonable approach for the companies is required. The situations in the visited companies have some things in common:

- Rather low maturity regarding PM capabilities (between levels 1 and 2) [4]

- A lot of turnkey projects
- A high interest in improving project performance
- Not fully implemented Project Management Offices (PMO)
- Lack of training in PM

The situation is such that companies are demanding to undertake lots of projects, but with a low maturity in PM. They have money and too many things to do, therefore, invest time in getting the knowledge and expertise in PM is not an option. They will hire all the required services, including PM.

But this takes us to the point in which not everything can be hired. The company has to know how to control projects and how to act as a client. But even the client, in a turnkey project, should play his role regarding PM. We will try to find approaches in this sense. PMBOK, for instance, does not have exactly this approach [5]. According to PMBOK, either you do your project internally in the organization, or you have a contract which originates a project but in this case the complete PM function is transferred to the contractor, who will undertake the project and deliver the project outcomes. One possible approach will be the use of EPCM (Engineering, Procurement and Construction Management) contracts [6]. The EPCM contractor plays more a role of a professional consultant than a contractor, managing the contractors for the employer and providing advice in design and construction.

Another clear identified need is the function of portfolio management, rather than individual PM. Companies are not concerned about managing in the best possible way one project, because this function has been delegated to the contractor. There are so many things to do that they are more focused on the forest rather than on individual trees. Therefore, it is important the selection of the right projects for "doing the right work" [7].

The creation of a PMO, and its maturing process, is also a reasonable approach [8], to be conducted in parallel with other initiatives, as well as to improve the competences of people involved in projects. To create or improve the methodologies of PM is also recommended, but first priorities have to be set, in order to define the most appropriate roadmap in each case.

And finally, as every company is facing its own situation, the best way to identify the starting point is through performing an initial assessment of the current PM capabilities and maturity [4].

4. Results and Conclusion

The considerations explained in this contribution make us first conclude that it is very important to take into account both the local culture and the special situation of the country. Secondly, the exploration of the following possible solutions for the companies in Libya, regarding the management of projects:

a) As short term solutions:
- Conduct an initial assessment of the maturity and capabilities of PM
- Implement the portfolio management function, for "doing the right work"
- The use of EPCM contracts
- Consultancy services for PM and change management
- Development of a basic methodology for PM
- Creation of a PMO

b) As medium or long term solutions:
- Mature the PMO
- Development of competencies in PM

- Continuous improvement.

5. References

[1] http://www.bbc.co.uk/news/world-africa-13754897, last visited on Jun 10, (2013)

[2] http://www.economist.com/topics/arab-spring, last visited on Jun 12, (2013)

[3] http://www.imf.org, last visited on Jun 12, (2013)

[4] R. Wysocki: Effective Project Management. Traditional, Agile, Extreme – 6th Edition, John Wiley & Sons, pp.507-509, (2012)

[5] PMI: A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition, Project Management Institute Inc., pp.66-70, (2013)

[6] http://www.herbertsmithfreehills.com/-/media/HS/T-290612-6.pdf, last visited on Jun 10, (2013)

[7] PMI: The Standard for Portfolio Management – Third Edition, Project Management Institute Inc., (2013)

[8] D. Bolles: Building Project Management Centers of Excellence, Amacom, (2002)

New view on project and investment management in a more agile IT and agile Business environment

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Abstract: Historical view on project based working and the new trends in IT shows that there is a need of new steering and management of investments. The gab between the agility of the market with it's customers and the way of managing projects increases continuously. Using a cybernetic model to steer this complex system allows to get more insights and to adopt the way of project management.
Traditional steering based on Scope, Timing, Resources and Quality is not sufficient anymore. User integration, value commitment and delivery of customer's expected out-come in an agile B2B and B2C environment allows to create value as early as possible. Market entry is prioritising. With a case-study in the financial industry for fundraising and grand management an agile business combined with an agile IT shows that significant savings in time and budget are possible and a value creation can be ensured early.

1. Historical view on projects and investments in IT

Managing an IT-organization in the context of project based working is not an end in itself. It is always a supporting activity to allow processing and to deliver value to the customer. Thus there is a well-defined link between management on the one hand, and processing and delivery, on the other. Investments are also aimed to deliver added value thus they are linked to management. This link is the well-known link of project management.
Just before the Industrial Revolution the customer needs were served by small independent service providers and self-care. Any investment was done generations before and continuously improved and maintainedi. We can define this as business model BUS.0.0. which delivers services to a customer CUS.0.0. Within the business model BUS.0.0 the investment model was INV.0.0. A balance was present.
The causes of the Industrial Revolution remain a topic for debate. However, recent research into history of Marketing ii has challenged the traditional, supply-oriented interpretation of the Industrial Revolution and pointed out that the changed needs are more the cause of change than assumed so far. This means that the needs of the customers changed towards CUS.1.0.: More needs to be fulfilled for lower prices. As the customer model changed the business model had to follow. The Industrial Revolution was the transition to new manufacturing processes to fulfil the new customer needs. Thus the business model BUS.1.0 was created and implemented. In this business model investment was seen as the same as processing and delivering of value. The Industrial revolution was characterized by growth and profit increase which was the base for the merger of management (investment as well as processing and delivery). By that the investment model stays on INV.0.0.
During the 1940s the military needs requested a more structured approach for investment management. As the Second World War was requesting a huge amount of military equipment the needs of the customer changed towards CUS.2.0. The available business model BUS.1.0 was no longer valid and on top of this, the investment management INV.0.0 even less useful. Business followed the new customer and faced the distance between BUS.2.0 and INV.0.0. Thus BUS.2.0 has to change the investment model in order to be able to deliver the expected

value. The first steps towards investment management were done within the INV.1.0 model. In the American military industry (e.g. development the B52s) the line managers are also executing the function of investment manager. This mix leads to a "over-the-fence management": Once the responsibility is executed the results are thrown "over the fence" with the hope that some will picked it up. Within the next 20 years best practices are identified and shared. The first steps were done towards splitting of processing and delivery on the one hand, and investment management on the other hand.iii

The first real investment model was created by the American military governance to allow investment steering during the Second World War. The aim was to take care about the timing of delivery (military equipment was necessary to be delivered on time) and the costs (there was a certain amount of equipment to be delivered despite limited resources). The target system Scope (S), Timing (T), Resources (R) and Quality (Q) was created.

Figure 1: Basic Investment Management on Scope, Timing, Resources and Quality

From that moment onwards, the link between management, processing and delivery, and investment has continued to grow. As the needs of the customers are changing towards more stable spending and value delivery (CUS.3.0) the business models are trying to follow suit with a model BUS.2.5, but somewhat delayed. This delay was accepted and even reinforced. The investment model has not been able to follow and stayed behind on INV.1.5.

Let us consider Moore's lawiv: The change on the computer market growths exponentially. Modern researchers as Ray Kurzweilv believe that the exponential improvement described by Moore's law will ultimately lead to a technological singularity: a period where progress in technology occurs almost instantly. The same trends can be found in other industriesvi. As the technology changea the customer follows these trends and develops toward more modern customer models CUS.4.0 or even CUS.5.0. The business is not able to follow and stays on BUS 3.0 and the investment model even follows later with INV.2.0. As we look on modern investment management methods like PRINCE2vii or COBIT 5.0viii, they are dealing with business investments enabled by (IT) technology but they all focus on the one-dimensional investment management.

2. Challenges of today's project and investment management

Otto Scharmerix mentioned that there is a need to leave the old ways of management behind. This old principle was to focus on "silos" in oder to describe business structures as it is traditionally done with the "over-the-fence management". He beliefs that this management has led to the modern crisis. This one-dimensional investment model must be overcome inside as well as outside the business units.

The framework for modern investment management is based on two main ideas. The first assumes four stages in the evolution of Western capitalism. It refers to the history of investment management as described above:

- Capitalism 0.0: the first industrialization. Investments are managed by the line in a hierarchical way (focus on delivery of goods). The classical separation of operations and investments dried out.
- Capitalism 1.0: the free-market or laissez-faire capitalism (focus on growth).
- Capitalism 2.0: a more regulated European-style stakeholder capitalism (focus on redistribution)

- Capitalism 3.0: an (as-yet unrealized) intentional, inclusive, ecosystem economy that upgrades the capacity for collaboration and innovation throughout all sectors of society (focus on ecosystem innovation).

The investment management method changed in parallel during the time described herex but with a slower speed. But still today the motivation is to manage investments based on finance-driven KPIs (Key Performance Indicators), the challenges of the generation (X).0, however, are not manageable with methods of the generation (X-1).0. Thus the new generation (X+1).0 is necessary to be prepared today for the future because – as Osterwalder & Pigneur have argued - "today's models are most likely to be outdated tomorrow"xi.

The second idea is based on the fact that inter-technology thinking will not allow to successfully deliver any investment. Therefore modern management methods need transversal and cross-technology methods with clear future-oriented targets and visions. Here the system of cybernetics can help to model investment management in a new way that may be able to solve the challenges of the capitalism 4.0xii.

Beside the rapid changes of the economical environment, information technology is even changing more rapidly. One example is the usage of IT. 40% of the devices used to access business applications are personally owned by iWorkers, it went up to this figure from 30% in 2010xiii. Managing technological change like computerisation of IT requires a combination of people, organization and this technology to ensure that these new technologies are used safely, securely and efficiently and to effectively manage the changes being rolled out to the customers.xiv .

Today, IT systems often enforce some human mechanization, which may have reinforced the sense among employees that they should be saying NO to certain new devices of IT —a perception which a project manager may need to take into account.xv

Other trends are the battle of mobile devices, Internet of Things, hybrid IT systems and integrated eco systems.xvi It looks as if by 2013, mobile phones will have overtaken PCs as the most common Web access device worldwide and that by 2015, over 80 percent of the handsets sold in mature markets will be Smartphone.xvii The Internet of Things (IoT) is a concept that describes how the Internet will expand because physical items such as consumer devices and physical assets are going to be connected to the Internet. Key elements of the IoT which are being embedded in a variety of mobile devices, include embedded sensors, image recognition technologies and NFC used for payment and other transactionsxviii.

Hybrid IT systems are the answer on the request to do more with less. This view challenges IT departments to play multiple roles in coordinating IT-related activities, and cloud computing is now pushing that change to an even higher level. This also will have impact on project management in IT.xix

The market is undergoing a shift toward more integrated systems and ecosystems. Thus it is moving away from loosely-coupled heterogeneous approaches. This trend is driven by the users' desire for lower costs, simplicity, and more assured security. This means the ability to have more control of the solution as well as to offer the complete solution in a controlled environment, but without the need to provide any actual hardware.xx

3. Impact on project and investment management in IT

The economical as well as the technological changes and their even increasing change frequency need to be integrated in new concepts of IT investment management. The system of cybernetics offers ways of looking at investment management which start with the acceptance of embeddeness as part of contextual complexity. Together with further multiple perceptions it tries to define and handle environmental influences and system components to the benefit of the investment. This is a view of investments as political issues on the organizational agenda rather than as closed-in activities construed out of corporate goals, it means that these issues need to be piloted through the whole organization while satisfying all relevant stakeholders.

It means furthermore to deal with investment management 4.0. Thus it is necessary to be aware about components within and without the business unit which the investment is aimed for.

Therefore the border of the investment must be identified as the border of the business system which interacts with its environment. Thus we need to consider physical borders (like buildings, distance, etc), furthermore social and psychological borders.
In this way the environment may be considered an inherent partner of the investment. The environment interacts with the investment as well as the investment interacts with the environmentxxi. According to the degree of interactions we can have an autarkic investment (low interaction) or a dependent investment (high interaction).
Now let us look at the business unit as a system with its different inputs, outputs, internal processes, its environment and its feedback loops which create the system stability and allow change and development for the system (Fig. 2). This has been extensively analysed in the OSTO-Approachxxii which is being used here as the basis for the following system discussion.
Each system has to deliver output . This output have to be the customer's expected out-come. Only if we deliver what is requested in scope, quality and timing with the available budget the system will be reliable. The output is by that not sufficient but necessary. The main terms to be considered here are the Mission Statements.These are the Reason of Existence and Meaning.
The first statement to be considered is the reason for the system to exist at all, e.g. the needs or expectations of customers to make use of the products or services of the business system. Today this Reason of Existence of the system is usually well known to the system actors. Certain mission statements are defined to describe this Reason of Existence, and the main financial calculations in business cases refer to such statements. All processes of today's investment management in such a business system are aligned in this way.xxiii
Modern investment management has also to deal with the Meaning of its output with regard to the customers as well as to society at large. It means the long-term value-creation of the system leading to future oriented execution of output, long-term thinking and looking at the wider context of system output rather than the economic reality of today. In this way the main content of this Meaning of system output is defined.
Finally the basic reasons are dealing with the Basic- and Meta-values, the philosophy of live and living as well as the belief and conviction of the individual and the organization.

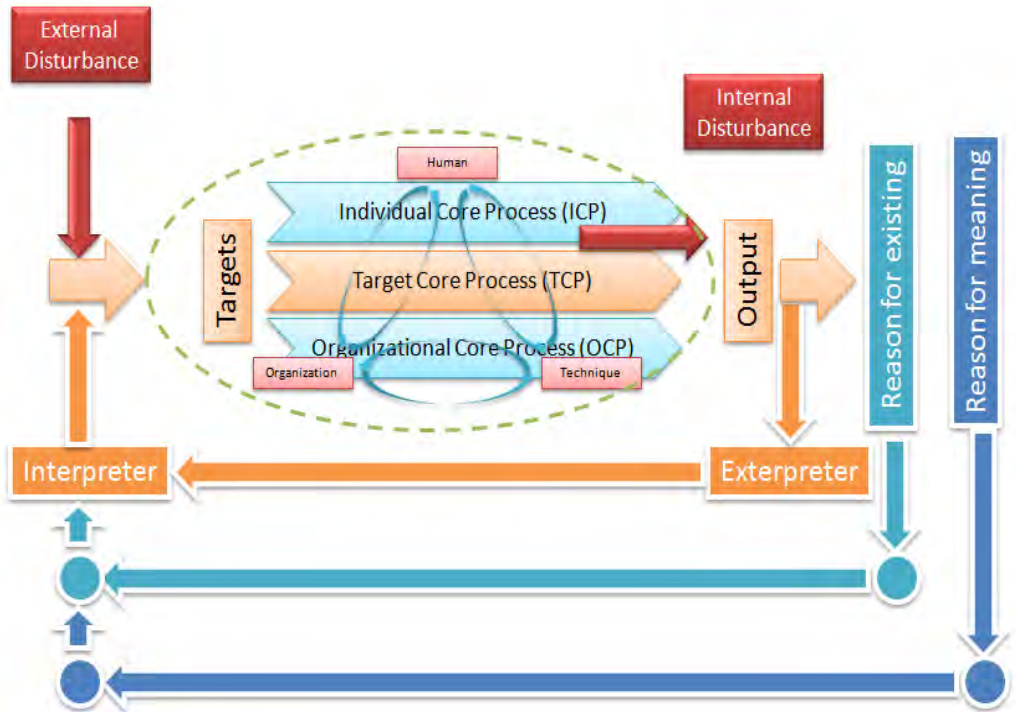

Figure 2: Complex cybernetic investment management framework

Following this system approach, it means to manage the whole context of a project: to deal with all components of the system including the acceptance of targets and long-term aims, and to ensure the delivery of the output according to the Mission Statements. In particular, the Reasons for Existence of the system are to be coined as the Business Objectives, they are distilled from the Business Needs in an iterative and continuous process: Thus the continuing existence of the system and the accuracy of defining the Business Needs and Objectives are managed. Additionally they provide assets as the input will be balanced with the value of the objectives through feedback loops (blue color).
On the operational level, management means the alignment of the customer's expectations of output with the Objectives and its translation into business targets. Thus the organization as a system will reach the expected fulfilment of the objectives (orange color).
Furthermore there is the management of disturbances (Risks). It needs top be done with the resources available, within the timing and the scope of the Target Core Processes which are part of the tactical level of project management (Red color).
The system components are interacting within the system as well as the system is interacting with the environmentxxiv as mentioned before. There is the need of stability and orientation within investment management. This orientation can only be given on a vision level through the statement of the system Meaning. Long-term survival of the business as this cybernetic system is dependent on having defined sustainable and future-oriented Meaning statements. The focus here is on the system usefulness in terms of sustainability, e.g. in the context of individual, cultural, ethical questions and expectations within society.
These Meaning statements imply that there are values defined for the owner of the investment. Values are one dimension for measurement of effectiveness. Here we consider efficiency versus effectiveness: Efficiency is measured as productivity metric, and effectiveness is assessed by quality metricxxv. Being efficient means to spend less time, less money or less effort (or number of workers) on some output. This was the main aim in investment management of the traditional style. Being effective means to do the job according to the expected qualityxxvi. Quality of output in this perspective means that the products or services have to be valuable for the customer which means that they contribute to the customer's values.
Beyond the original OSTO model, two new roles are introduced in the system model as described here. The first role is the Interpreter. It means here that the interpreter has the responsibility to understand certain orders (e.g. management decisions) and translate them into actions. The interpreter has to be a part of the system to ensure that the necessary actions are taken. Some references describe the interpreter as mirror within the system to allow the system to change according to new challengesxxvii.
The role of interpreter is necessary as the steering injection into the system based on feedback information. Thus the second role is the Exterpreter. As the interpreter injects signals into the system, the extrepreter extracts information from the system and its output, and changes this information into a certain language to allow closing the cybernetic loopxxviii toward the interpreter.
Taking this system view into account, it means dealing with the challenges within IT in a specific way: even working in an agile business includes to focus on benefit and value creation on mid- and long-term, beyond mere short-term decisions. Some investors define objectives for risk (like KRI) and performance (like KPI) by using portfolios of investments and managing these projects based on these figures. Others use IT portfolio management to enable their management teams to align IT investments with strategic objectives.xxix Others are using Cost-Benefit Analysis in retro-perspective for IT investments.xxx
As IT investment is changing towards agile delivery also business will change to more agility. Iterative delivery of products in B2B and B2C will allow to create value and earn benefits from the early beginning. Therefore, as mentioned above, modifications to the traditional decision criteria –mainly economically and technically focused – are necessary to value creation and services delivery. The current emphasis on how, why, when and for whom investment

management systems as stated with INV 1.5 are not suitable in this perspectivexxxi. Comparing with the Agile Manifestoxxxii the actual way of working should be modified. Especially the human side of IT development need to be changed. The today approach is using a bottom-up methodology to address a wider set of benefits and risks while creating the greatest benefit for consumers and society. This can be even improved by incorporating communal and societal criteria and promoting growth. These aspects are wider than the pure economical reason for existing. IT investments may contribute with partial future proved solution to resolve many of the problems faced today with taking care about our durability and not trying to solve the possible problems of tomorrowxxxiii.

4. Handling the complexity

As it is not easy to track benefit and improved value during the execution of the project the agile delivery allows to get more insight. While a selected group of trustable customers or users are in touch with the first shippable product a clear and open feedback allows to estimate the available value and benefitxxxiv. As we take care about all aspect in the cybernetic system we know also about the humans in our IT investment system. Using this first iteration with feedback of the user group the customer can decide either to penetrate the market with the first shippable product or not and go into a next iteration.

By that we see that the first and most important component of our system is the human. He is the one who delivers as a part of the team as well as the one who will use the deliverables later on. This extension to the original OSTO approach follows the agile trends. xxxv If we can organize a user group to execute reality tests we will get additional non-monetary value on top. This user group will take over the role of "Extrepreter", extracting the delivered value from the system end analyze them. Also the results of this extrerpretation the user group will also deliver input to the system as interpreter. Rather, the people who are starting in a certain role in the IT project (such as a specific web development platform) will often have different talents, preferences, and attitudes than others. Over time, bringing both together and let them work contemporary will also make them develop different skills and reinforce attitudes and existing behavioural differences.xxxvi A customer become thinking as a developer and a developer starts thinking as customer. The user group becomes part of the team and the exterpretation and interpretation tasks are assimilatedxxxvii. This leads directly to a second validation and steering loop with the reason of meaning while the reason of existing is the loop with the traditional (legacy) project management based on the business case.

Beside user groups integrated into the system a continuously challenge of the contribution to the benefits and value is necessary. Therefore a X-reference is necessary to identify the contribution to the strategic drivers (taking care about the investment management model INV. 1.5) as well as the values and customer expectations are necessary. It is not only necessary to do things right but also doing the right thingsxxxviii. This principle of the investment management model INV 1.5 should also be adopted to the reason of meaning. Each potential shippable product have to fulfil also these indicators. As these indicators are more stable and combined with an agile business approach allows the customer to deliver as much as needed and as less as possible solutionsxxxix.

These X-references need to be made on different levels. Not only the fact that there is a link between customer's expected out-come and the value and benefit but also the intensity of the link is relevantxl. The X-Ref have to be developed both for the link between the stakeholders (incl. user group) and the values as well as the link between the value and the customer's expected out-come. This will allow the project manager to support the selection of the deliverable items of the iterations to create the customer's expected out-come. A wide spread set of visualisations is available to present the results of these X-referencesxli. Practical research shows that these visualisations are necessary for the success of the projectxlii.

Finally the project management within IT need to deal with the principle of loosely coupling of business and IT. Using this principle the business process is loosely couplet with IT processes and by that with IT investment processes. Each potential shippable product have to be usable.

The user group agrees on it and the business process can be implemented to let the delivered product work. This way of working can be compared with an practically implementation of the dual designxliii. Here the delivery starts with two extreme alternatives. One alternative could be a full automate steering the other one is the manual operator. Starting with the manual operations the business is already able to earn value by knowing the process and using by example paper based information processing. The first step in adding value is by that knowing the process and implementing this (as a pilot) in the user group. After this first feedback and adaptation the potential customer's expected out-come can be used in the market. By that a fast value creation is guarantied. All the other iterations will deliver more and more automation and allow a wider market penetration with as less as possible manual work. This way of working request the necessary trust between all involved parties and the conviction that more automation will be delivered in the next iterationxliv.

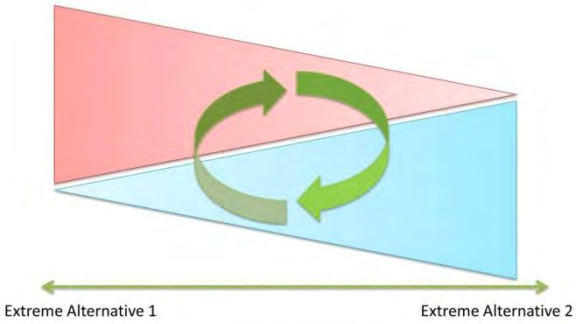

Figure 3: The dual design

Evaluate all alternatives on their impact on the objectives and values will allow you to take the necessary decisions. If they have a positive impact than the change should be considered as positive. If not, than the investment can be stopped or changed with as less as possible lost effort. This leads to an agile Program Management Approach[xlv].

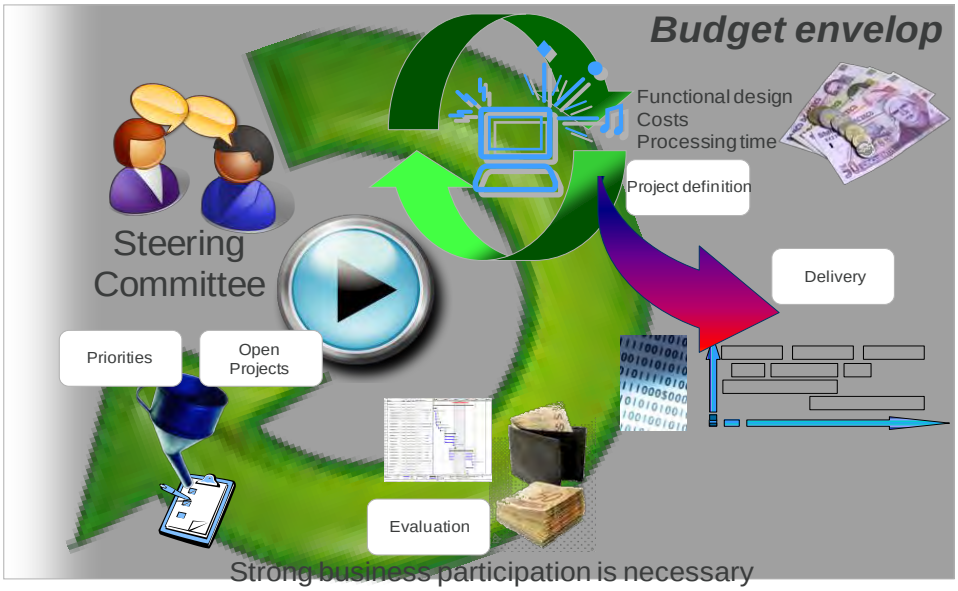

Figure 4: Agile program management approach with stabilized delivery

5. Case

Executing IT projects within the financial industry beside the above named constrains additional regulations are valid. This leads to the fact that a lot of market entry points are missed due to complexity management. These market entry points are specific moments in time (like fairs,

events, change of regulations, etc.) which are fixed externally. Unfortunately the time between facing this point and optimal market entry point is relatively short. A full blown IT project dealing with all aspects valid for IT in financial industries will lead to a delay or extend the costs unacceptable.
During a case the revamping of the automation of a back-office should be done. The task of this back-office was fundraising and grand management. The actual system was build in End-user tooling (Access) and run out of support and, on top of this, did not fulfil legal requirements. During the years the implementation was extended, reduced or changed that way that nobody actually know the functional and technical design. The integration of these applications with the core data system of the financial institution was also organically grown.
As this entity wasn't able to execute their tasks supported by the tool the pressure on the project increased dramatically. Together with the (senior) general management we decided to apply an agile business approach. In the first iteration we designed a business process As Is. Together with the customer we decided to implement a iterative business implementation based on a pre-)defined value system where the traditional project management aspects (budget and timing) are in the minority. As one of the most important value the X-reference between value and cost per customer's expected out-come.

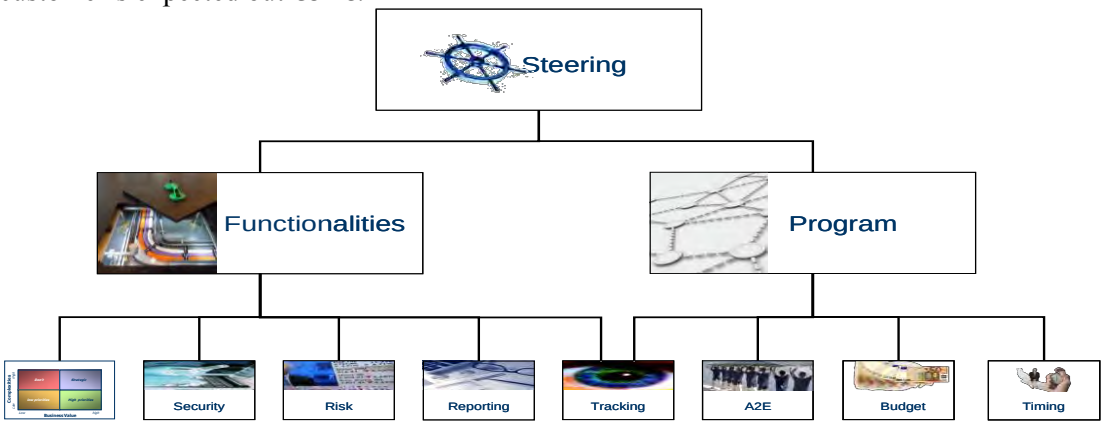

Figure 5: The used value system to evaluate the customer's expected out-come

The first iteration was based on a temporary export of data processed in a created Excel file. After each week a manual process was executed to import the data again to the core banking system. Using this first almost manual business process allowed the customer to continuo with the business. The link between business process and IT process was loosely coupled.
In the second iteration we executed a RFI/RFP where we request external vendors as well as internal ICT department to apply. The "build or buy" decision was fully integrated into the RFP-procedure. Based on trust IT and the customer selected a package with tailored interfacing to the core banking system.
The third iteration was the implementation of the package for the back-end and integrate this with the core banking system. The build-in processes are implemented witch leads to changes to the actual business processes. In this case the adaptation of the business process towards the presented processes of the package was more efficient and effective than changing the package. After the implementation on a test environment customer and IT developed in weekly iterations together with the user group the screens, workflows and documentations in parallel. After a period of 4 weeks parallel use of the pilot (package) and the manual process the user group ask for a full roll-out.
The fourth iterations than extend the back-office package with the web portal of the customer. And extent the functionality of the interfaces with the core banking system. The web portal allows the broker on the field to access partly data of the package without contacting the back-office. This increased the benefits and fulfils the need of more autonomy of the employees in the field.

The fifth iteration than provided the full integration with the bank-branch system. As this system is under control of regulators these changes has to be developed according specific regulations.
This case shows that the combination of an agile business approach with loosely coupled business and IT processes in combination with trust and an empowered user group enables a delivery 6 month earlier (instead of 24 month we delivered in 18 months) and with almost 18% less than foreseen budget . The users themselves decided the delivered features and got more insight into the processes both on business and IT. The delivered customer's expected out-come fits almost 93% to the expectations and until today (4 years later) the cooperation between IT and customer still allow a effective delivery during maintenance.
The opposite is that the expected effort and flexibility of both customer and IT resources was increased. Also a certain level of maturity and tolerance was necessary to work in the user group. Some members till believed that the "over the fence" method would have delivered more valuable outcome, at least on short term.

6. Results and Conclusion

Project Management is grown through the years. The historical discussion shows that the gab between the agility of the market with their customers continuously grow. For IT the additional challenge of the rapid changing technology is a surplus on the gab.
Using an system-cybernetic approach for project management shows that the traditional business case bases steering is not sufficient. To be able to follow the markets there is a need for different adaptation on the project management in IT.
The first change is to integrate as soon as possible all parties in a user group. Even customers or users should be integrated from the early beginning. Only they can assume the acceptance of any solution. As the market is rapidly changing there is no second chance once the user and customers are lost.
The second adaptation is to keep the traditional KPIs in mind but focus on values and meanings. These values and meanings are more stable and allow the investor to create a identification. Of cause each investment should still fulfil basic economical rules like having a positive Business Case.
The third adaptation is to cooperate agile on both side on business as well as on IT. There is in a lot of cases no need of a full blown implementation for a first market entry. By that IT is always coming on the second place after creating value.
To be able to execute projects with these changes trust between IT and business must become granted and both parties need to keep the targeted value in mind. Finally a loosely coupling of business and IT is necessary. By that the business process can change without direct impact on IT processes and by that with IT investment processes.
A case in the financial industry shows that the above named prerequisites in combination with an agile business approach with loosely coupled business and IT processes together with trust shows significant results. A delivery 6 month earlier (instead of 24 month we delivered in 18 months) and with almost 18% less than foreseen budget and a fit of almost 93% of the expectations is the measurable result. On top the exchange of knowledge and more insights of the other groups are also given fact.

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8. About the author

Frank Stumpe was born in Germany 1969. After a vocational training as mechanical he studied mechanical engineering at the RWTH University of technology Aachen, Germany. He finished his Ph.D. in project management in complex-cybernetic systems. In parallel he works as consultant in project- and change management at Trox Ventilation, John Deere, ÖBB, SBB, Holcim, etc. Frank Stumpe was lecturer at the RWTH Aachen for Project Management and

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The professional career of Frank Stumpe was international and crossindustrial. Starting from managing European research projects he works for heavy industry, food industry as well as hotels and transport. He was CEO of IPS Bulgaria Ltd. and member of the Group-ExCo responsible for training and methods. Today working as head of the competence centre project based working at KBC Group. He has app. 17 years' experience in all facets of project management.

9. References

[i] Mark Kozak-Holland, The History of Investment Management, PM World Today – July 2011 (Vol. XIII, Issue VII), ISBN: 13:9781554890965, 2011

[ii] Fullerton, Ronald A. (January 1988). "How Modern Is Modern Marketing? Marketing's Evolution and the Myth of the "Production Era"". The Journal of Marketing (New York City, NY: American Marketing Association) 52 (1): 108–125. doi:10.2307/1251689. JSTOR 1251689.

[iii] Peter W. G. Morris, Jeffrey K. Pinto, Jonas Söderlund, The Oxford Handbook of Investment Management, ISBN 978-0-19-956314-2, 2010

[iv] Moore, Gordon E. (1965). "Cramming more components onto integrated circuits" . Electronics Magazine. p. 4. Retrieved 2006-11-11.

[v] Kurzweil, Ray (2005). The Singularity is Near. Penguin Books. ISBN 0-670-03384-7.

[vi] Karl Aiginger, Speed of Change and Growth of Manufacturing, Structural Change and Economic Growth;
Reconsidering the Austrian "Old-Structures/High-Performance" Paradox, Austrian Institute of Economic Research (WIFO), 2005

[vii] OGC (Office of Government Commerce) (2009). Managing Successful Investments with PRINCE2 (2009 ed.). TSO (The Stationery Office). ISBN 978-0-11-331059-3.

[viii] De Haes, Steven, KPMG seminar 2013, Antwerp

[ix] Scharmer, Otto, Seven Acupuncture Points for Shifting Capitalism to Create a Regenerative Ecosystem Economy, Ox ford Leadership, Journal, shifting the trajectory of civilization, June 2010 • Volume 1, Issue 3

[x] Weiss & Wysocky, 5-Phase Project Management, Sustainable Project Management,2005

[xi] Osterwalder2, A., & Pigneur, Y.,. Business Model Generation. New Jersey, John Wiley & Sons, Inc., 2010

[xii] Stumpe, Frank, Course Project Management in practice, Summary of model, course and scientific excurse, ISBN 9783839114803

[xiii] IDC information worker custom survey, business IT custom survey, sponsored by Unisys, 2011

[xiv] Avanade® Research & Insights, Global Survey: Consumerization of IT, 2012

[xv] The consumerization of IT, The next-generation CIO, pwc, Center for Technology and Innovation, 2011

[xvi] Gartner Identifies the Top 10 Strategic Technology Trends for 2013, Gartner Symposium/ITxpo, 2012

[xvii] Covering the intersection of tech and investing, Eric Savitz, Forbes Staff, 2012

[xviii] The Internet of Things, A critique of ambient technology and the all-seeing network of RFID, Rob van Kranenburg, 2007

[xix] Managing hybrid IT, Searching for the right blend of desktop and cloud, David Howell, 2013

[xx] IT ecosystems: A new paradigm for engineering complex adaptive software systems, Rausch, A., Digital Ecosystems Technologies (DEST), 2012 6th IEEE International Conference, 2012

[xxi] Staffan Johansson ,Mikael Löfström, Östen Ohlsson, Göteborg University, Separation or integration? A dilemma when organizing development projects, 2007

[xxii] H. E. Krug In: K. Henning und B. Harendt (Hrsg.): Methodik und Praxis der Komplexitätsbewältigung Diagnose und Design komplexer Organisationen OSTO Systemmodell, . 1992

[xxiii] Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Harold R. Kerzner, 2013

[xxiv] Frederic Vester, Die Kunst venetzt zu denken - Ideen und Werkzeuge für einen neuen Umgang mit Komplexität, dtv, München; ISBN 978-3-423-33077-0, 2002
[xxv] Petzold, Stephan: Einführung der Balanced Scorecard als Performance-Meß-System für systemische Organisationsentwicklungsprozesse. Unternehmenskybernetik in der Praxis, Band 4: Shaker, 2001
[xxvi] PURVA VERMA, Dr. Rao, EFFICIENCY VS. EFFECTIVENESS, 2013
[xxvii] Brandt, Dietrich: Human-Centred System Design - First: People, Second; Organization, Third: Technology. 20 Case Reports. Aachener Reihe Mensch und Technik, Band 42. Aachen: Wissenschaftsverlag Mainz, 2003
[xxviii] Stumpe, Frank, Project Management in practice, 2013
[xxix] Generating Premium Returns on Your IT Investments, Peter Weill and Sinan Aral, 2006
[xxx] Vaughan, J., Leming, M., Liu, M., and Jaselskis, E. (2013). "Cost-Benefit Analysis of Construction Information Management System Implementation: Case Study." J. Constr. Eng. Manage., 139(4), 445–455.
[xxxi] Using Agile to Create Economic Value for Society, Cohen, Stephen Money, William H., System Sciences (HICSS), 2013 46th Hawaii International Conference, 2013
[xxxii] Manifesto for Agile Software Development, http://agilemanifesto.org/, 2001
[xxxiii] ICT en duurzaamheid, IT Management Group, 2012
[xxxiv] Agile Practices to Accelerate the Delivery of Software: A Quantitative Study with Software Professionals, HICSS 2013: 4771-4779, university of Trier, 2013
[xxxv] The Software Requirement Development of Information System, Xianyu Li Hua Wang Xiaokun Li Huijun Zuo and Shan Wang, Proceedings of the 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE 2013)
[xxxvi] Plat Forms: Contests as an Alternative Approach to SE Empirical Studies in Industry, Lutz Prechelt, Ulrich Stärk, Proc. 1st International Workshop on Conducting Empirical Studies in Industry (CESI), San Francisco, May 2013, published on homepage Freie Universiteit Berlin, 2013
[xxxvii] Configural and pictorial Displays, Kevin B. Bennett,John M Flach in The Oxford Handbook of Cognitive Engineering geredigeerd door John D. Lee,Alex Kirlik. 2013
[xxxviii] Project Portfolio Management – White paper, Microsoft, Published: August, 2008
[xxxix] The role of BPM in the IT value-chain: Exploring how managing business processes and decouple business and IT, Charles Moller, in Advances in Enterprise Information Systems II, Charles Møller,Sohail S. Chaudhry, 2012
[xl] Sensitivitätsanalyse des strategischen Projektmanagements im Gesundheitsbereich, von Hannes Moser, 2003
[xli] Cool Features and Tough Decisions: A Comparison of Variability Modeling Approaches, Krzysztof Czarnecki et al, 2012
[xlii] A case study on variability management in software product lines: identifying why real-life projects fail, Huysegoms, T ; Stumpe F. et al., International Journal of Information Systems and Project Management, Vol. 1, No. 1, 2013, 37-48
[xliii] Diagnose und Design komplexer Organisationen OSTO Systemmodell, H. E. Krug In: K. Henning und B. Harendt (Hrsg.): Methodik und Praxis der Komplexitätsbewältigung, 1992
[xliv] Significance of trust in reputation building mechanisms, Radoslav Delina, Fraticek Janke & Michal Ticee, in in Advances in Enterprise Information Systems II, Charles Møller,Sohail S. Chaudhry, 2012
[xlv] ICT Program and Project Management in financial Industries - General conditions and methods, Lecture at Department of Information Systems (IS) at the University of Münster, Stumpe F., 2010

Investment Projects in the Energy Sector - Bottleneck Financial Sources

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1) Introduction

The energy industry is one of the most investment-intensive industries in the world. Asset projects in the organic growth or Merger & Acquisition Projects determine the investment policies of the energy industry in the European market. Investment projects in the hundreds of millions and even billions of euro and investment duration of 30-50 years are common.

The bottleneck for the investment activity of the energy industry are the financial resources of the company [10, p.3], especially in these days in which the rating agencies observe very well the dept/equity-ratio of all public and private organizations.

Numerous investment opportunities for energy companies can be differentiated. Investment in nuclear energy is interesting now to reduce CO2-emission but investments in coal plants currently are under political pressure because of the same reason. There are a large number of investment opportunities that competes for the limited resource “capital” like grid investments, wind parks or projects like electricity from the desert.

The economic theory in dealing with bottlenecks sets out clearly that profits can be optimized such that per unit of limited resource the profit needs to be maximized [12, p. 328]. To apply this in the above described capital restriction the energy sector has to focus on the internal rate of return (IRR) of an investment [6, p. 23], which indicates how much interest can be accomplished in one unit of capital used in a project. Of course, investment is not only decided by a purely logical and structured point of view - or abandoned. Short-term opportunities, stakeholder influences, tactical preferences and not least personal assessments of leaders play an important role as well. But the base of each decision is a business case (BC) based on the net present value (NPV) and the IRR [1, p. 93]. The BC pictures the expected

project into a mathematical model where - based on the NPV or the IRR method - the expected interest or value of a project can be measured and derived.

This contribution focuses on the immense practical relevance of the instrument of BC (NPV and IRR). In subsequent chapters the NPV/IRR method is presented. Thereafter the spotlight is directed to four issues of the use of BC, which makes its practical significance. These areas are a) force the participants to a careful planning, b) to manage risks in the project, c) to analyse sensitivities of a project in relation to important influencing factors and d) to use the BC as a basement for the project documentation or even the contracts with clients or internal target settings.

2) The net present value method

The net present value method is based on the opportunity cost principle. Its crucial point is then, that the company can use an available alternative. This relates in part to investment alternatives. For example, an amount of € 100 million can be invested in the project A (construction of a combined heat- and power-plant) as well as in the project B (purchase of company shares of a municipal utility). The NPV method shows which of these alternatives optimizes the profit performance of the company and therefore the company's value. The opportunity cost principle is also the basis of the NPV method in itself and therefore makes it possible to also assess individual projects. This is done by comparing the theoretical possibility to invest the money on the capital market [4, p. 97]. The funding requirements of the company are shown on the required rate of return within the NPV method. Is a project (for example the construction of a wind turbine) more promising than the expectations of any funds in the capital market, it is shown in a positive NPV.

The core of the NPV method is that the cash flows at different times have different values [4, p. 9]. Cash flows at different times cannot be compared directly - with the help of the NPV method all cash flows of an investment can be converted to a set time “t” and then the values can be compared or even added. Normally, this specific time is "The Today" with t = 0 in order to provide the decision-makers an indicator for the decision as simple, current and realistic as possible. The formula for calculating the net present value (NPV) is generally as follows [4, p. 13]:

$$NPV = \sum_{t=0}^{N} \frac{C_t}{(1+r)^t}$$

The Cash of each period (C_t) is discounted with the interest rate "r" as an opportunity interest rate of the company. These values (all are now in the time 0) can be added.

Dividing the rear part of the formula apart in cash for the period (C_t) and the discount rate ($1 / (1 + r)^t$), then the formula is easier to understand. The cash of every period results from the assumptions and conditions of the project. The discount rate is the mathematical part, which discounts the cash values down to the period 0 [8, p. 52].

The following figure illustrates this method:

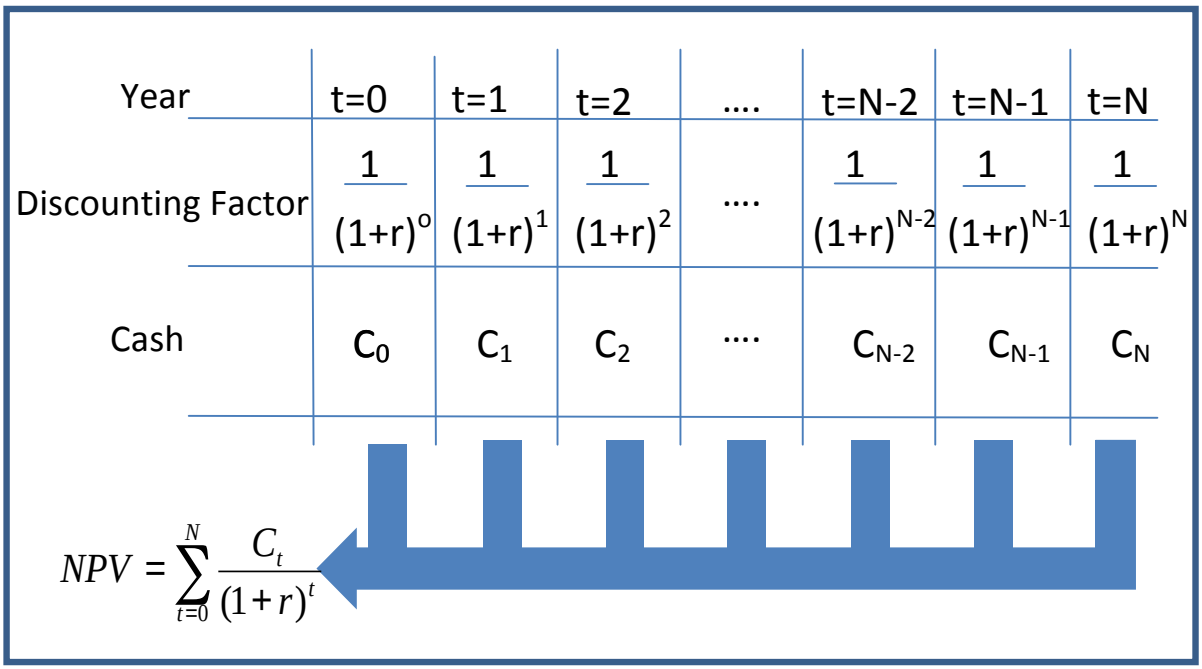

Figure 1: Discounting methodology

If the NPV is greater than zero, the project is positive – it should be performed. The returns from investment are therefore higher than a comparable interest in the capital market. If the NPV = 0, the investment is as good as a comparable investment in the financial market. This

situation of the breakeven point NPV = 0 we make later exploited in the calculation of the IRR. If the NPV is less than zero the investment should be discarded because they can better invest the money on the financial markets [4, p. 33].
The NPV can be interpreted as an additional value contribution for the company by the project (added value). If your company has the opportunity to perform a project with a positive NPV you should add this project to your portfolio, because by implementing it, the value of the company will grow.

One small example: it is offered to you to buy right now an existing windmill for 1.0 million Euros. After the 7 years it is out of the economic life time (high risk of malfunction) so the maintenance contract finishes as well and you have to demolish the windmill after 7 years (costs for this in 7 years: 100.000 Euro). The price for the produced electricity is fixed for the next 7 years and according to the situation of the wind in the site you will earn 350.000 Euro every end of the year in average by selling the electricity. You expect 50.000 Euros for the maintenance every end of the year. Your opportunity to give the money to the financial market would allow you to receive 5% interests every year (assumption: no taxes / no inflation). By applying the above mentioned formula the NPV for this example is nearly + 0.65 million Euro. So you should do this business – the cash of the project discounted to t=0 is very positive and the value of your company will increase by 0.65 million Euro.

A special role in the NPV method plays the target interest rate "r" for the calculation of the NPV. It is predicted from the financing opportunities of the company and a weighted average of the real rate between equity and credits. The company needs equity (as usual more expensive because taking the risks of the company) and also uses as much as possible cheaper loans. The lenders expect certain equity in the company, so that an unlimited extension of the debt is not possible. Beside this some additional costs (special premiums for riskier countries, special premiums for emerging markets) will be used so that in reality the company-wide common predetermined discount rates are far above any credit rate as for mortgages. In business 'r' is called ‘hurdle rate’ - so in order to be recommended for implementation every project should at least be on the level of the hurdle – better: much higher.

Connected with this we can go the next step to another calculation to bring transparency to a project. If a project achieves a higher NPV than zero, it is obvious, that the project has a higher internal return than ‘r’. By increasing ‘r’ in small steps within the calculation the NPV

will be smaller and smaller till NPV is exactly zero. This result of new ‘r’ in which the NPV of a project becomes zero is called Internal Rate of Return (IRR) [1, p. 71]. It shows to which extend the project will return profit on one Euro from the initial investment.

In the above started example the IRR equals to 22% - this investment brings 22 % return to every invested Euro. It should be implemented.

As mentioned the profit optimization under bottleneck conditions is dependent on the profit per unit bottleneck. The project with the highest specific profit per unit of capital is realized so first and then the project with the second highest profit etc. till the capital limit is reached [4, p. 138]. The profit per unit of capital is nothing other than the IRR. All projects with a lower IRR than ‘r’ will per se not be taken into consideration. All projects with a higher IRR than ‘r’ could be realized, but because of the limits of capital they must be restricted as well. The next diagram illustrates the business value optimization [5, p. 222]. Everything left of the capital restriction line ‘capital available’ is realized. The project portfolio A/B/C/D will be implemented.

Using the NPV method for the project portfolio the shareholder value can be maximized.

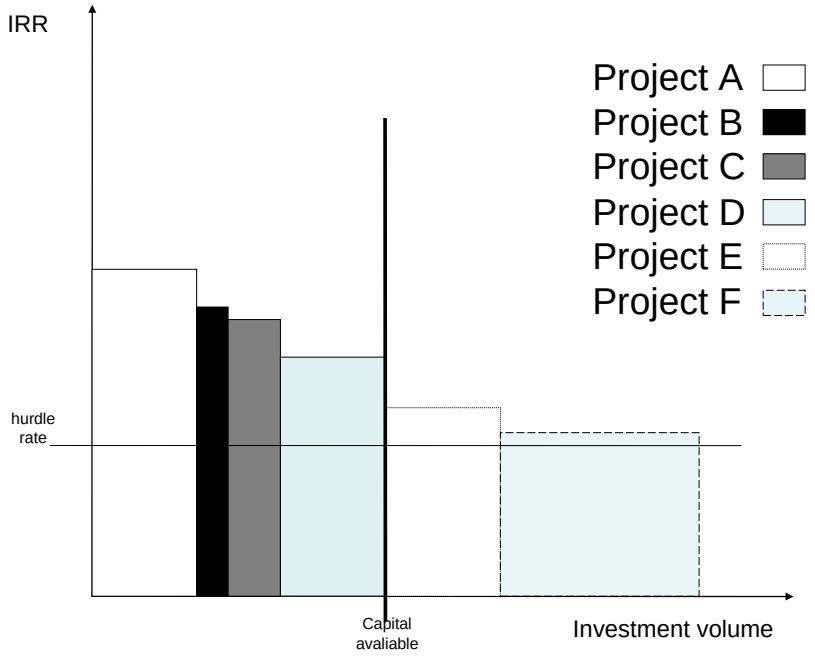

Figure 2: Optimization of the project portfolio under capital restrictions

If a decision for projects within the portfolio of options was taken the next step of success lays in the hands of the project team which now begins to realize the projects. The continued use of BC's offers a wealth of opportunities to manage projects successfully. In the next four chapters tried-and-tested methods around BC’s are presented which help to direct a project from the initiation down to the defined project goals.

3) Focus 1: BC forces to plan

The phases of a project are usually divided into the initiative, planning, execution and completion. Across from the beginning to the end the controlling is described as the fifth phase. In this section the focus is on the first two phases: initiative and planning. In the initiative phase often highly ranked managers generated ideas, which are then to realize by project teams. Then a project manager is appointed who is often close to his superior and tends to perform an uncritical implementation of the wishes of his boss. But the question must be at first whether this or that idea really offers customers the desired results or not or if the owner of a company really receives an added value from this project. To avoid this in almost all major companies so-called project manuals or investment policies are put into force that implements BC’s as an integral part of every decision for the management. Moreover, the four-eye principle is implemented by the project manuals: the Control Department usually creates the BC together with the Project management. A BC is created in a rough form already in the initiative phase to receive financial transparency. But the final go-ahead for a project needs a detailed plan and a detailed BC has to be created before the last decision to start. In customer business it is normal to calculate very well the profit by a detailed planning. Especially in internal projects the project planning is often seen as a not needed step what is wrong and often leads to burning money.

A mandatory BC forces all parties to see the project “financially”. The goal of a project is not only "technical", "seasonal", "design related" or "legal". This financial view provides the possibility to control shareholder value and corporate profits in a safe way.

4) Focus 2: The net present value method as an instrument to manage risks

If one accepts the benefits of BC's without the drawbacks to lose sight of (BC based on assumptions that may be wrong) there is a further application of the BC as a risk management tool. The NPV method allows calculating the concrete quantitative impact of the variances of the critical assumptions. An Example: given is the possible construction of a coal power plant, in which it is assumed that an efficiency of 43% can be achieved. With this efficiency, the BC (NPV) is positive. The engineers make clear, that the 43% can be achieved only if all factors (boiler insulation, supply water temperature, coal quality, the number of switch on/off of the boiler, etc.) can be optimally adjusted. The engineers assume that in the worst case only 41.5% can be achieved, but this is only to be expected with a probability of 5%. Using the net present value method now a second BC can be calculated with the efficiency of 41.5%. If this BC is still positive, it is clear that the project even in the worst case is without financial risks. If the BC would be negative in the worst case scenario, there is still no clearness. Here one can use the net present value method to incorporate these conditions to the BC in combination with their probabilities:
0.05 probability with efficiency 41.5%;
0.95 probability of occurrence with 43% efficiency.
These values can be processed easily in a BC.

In the comments on the discount rate "r" in Chapter 2 it has already been noted that risk premium can be used. So the NPV method also can be a measure in the risk management! Increased return on investment requirement creates reserves for project failures - it can be seen almost as an internal insurance.

5) Focus 3: The NPV method enables to analyse sensitivities of a project in relation to important influencing factors

As was shown in the previous section, the creation of a BC allows a greater transparency in risks that have been identified by project members. The NPV method can also be applied as a method to analyse sensitivities of a project in relation to important influencing factors [4, p. 122]. Compared to the chapter above this is a contribution to the identification of new risks. Such an analysis is performed to look how the BC and thus the proposed project respond to disturbances. An example: if the guideline for investment projects defines a discounting factor "r" in a transparent way in general all is clear. But investments in the energy sector are long term and it is easily possible that the opportunities to finance this investment might change

during the project duration. To examine how the project responds to changes in interest rates it can be reduces or lifted in 0.1 %-steps and one can easily see how the BC is responding to this factor. If the results depend very much from “r” it can be advised to seek for long term financing contracts with fixed terms.

Sensitivity analysis are often used for changes in the exchange rates or oil price fluctuations (than can be hedged). Inflation or staff cost trends are further applications for sensitivity analysis.

It is clear that the BC can offer help in the identification and analysis of risks. A BC is a reflection of future actions but it can also help to achieve these targets and to force these future actions to be successful.

6) Focus 4: Liability of approaches in BCs

Very often project managers who lead the project or the high level manager who initiated the project like to show the costs of the project on a low level and boost the possible profits. Both – project managers and the management - have a high interest to do the project. It is the idea of the manager and the project manager wants to show abilities .Costs and profits will “happen” in the future and no one might check it than. This leads to a nice BC with high profits. After the decision to go for the project all participants tend to lose sight of the BC. Here are mentioned two examples that illustrate the problem:

a) The marketing director has prepared an advertising campaign for the product "gas" to generate about 10% more customers (about 15,000 households). But the campaign is so expensive that the BC would have a positive result only with the additional margin of 18,000 new customers. Thus he quickly estimates a few thousand customers more – knowing that the 10% estimate was already based on instincts and therefore an increase to 12% is difficult to appeal. With this change the campaign even after protest of the Control Department will be implemented

b) The locally active XY utility for electricity and gas will be asked in the context of the overall corporate strategy to outsource its IT department and to integrate into the central IT Company of the Group. XY has to pay than an IT-service fee to headquarter. The time savings and synergies are promised to be built in the centre and should be passed with 50% to XY. Thus the XY-BC is positive per definition in

comparison to the status quo. But in the second year after introduction of the central IT, the IT-costs billed through the centre increased such that now the external IT costs by far exceed the former stand-alone cost.

These examples show realistic cases how to manipulate BC or not to fulfil promises – this can be resolved with a link to the used BC.

In case a) the bonus award can be linked to the success of the campaign. The Marketing Manager shall be notified in advance that his bonus is linked to the achieved number of additional gas household customers. It is important to tell him before because the number of assumed new clients (e.g. 15,000 or 18,000) stands for 100% of his bonus - deviations above and below are taken into account in the bonus percentage. Suddenly you will be able to observe that the motivation of increasing to 18,000 new customers is greatly reduced. Even the Marketing Manager began to work on such savings in the marketing campaign that the BC to positively even so. This example can be applied to almost all projects that contain individually identifiable components with a unique responsibility assignment to employees. These identified components of the attachment of premiums can be: budget, bulk buying from suppliers, software costs.

In case b) one can recognize a simple rule of risk management: "all that is said can also be written down". It would be advisable that the representatives of the IT headquarter write down their promises 1:1 in contracts for the duration of the BC. This guarantees XY not to have just nice promises. In combination with variable pay it will lead to success otherwise the IT headquarter could keep the promises towards XY but higher actual costs could disappear in the large central budget.

The liability of the essential assumptions of BC's can be interpreted as a risk management tool. Uncertainties are fixed by the binding commit to contracts, agreements or objectives. This not only in general but also related to components of the project – it makes the project more stable.

7) Summary

The scientists speak of the Net Present Value method, but in practice this is called a Business Case and this implies the use of NPV. BC's are used in order to select alternatives: the best projects are allowed to use the scarce capital resources. In the energy sector, the NPV - in addition to the strategic filter of a company - is the main selection criterion for future project portfolios. The portfolio is determined by the order of the IRR. But BC’s are not only for project decision or selection. It forces to a careful planning and provides the basis for the on-going project control. BC allows the risk assessment and identification by calculating various versions or sensitivity analysis. By the force to plan, the support for risk management, the possibility to choose the right portfolio, to connect salaries and contracts and a controlling tool to reach the defined target the circle of a successful project management is closed.

Bibliography

[1] Biermann, Harold and Smidt, Seymour, The Capital Budget Decision, Macmillan Publishing, New York, 1984

[2] Enthofer, Hannes and Haas, Patrick, Handbuch Treasury, Linde, Wien, 2011

[3] Gordon, Myron, Finance, Investment and Macroeconomics, Elgar Publishing, Hants, 1994

[4] Hax, Herbert, Investitionstheorie, Physcia Verlag, Heidelberg, 1993

[5] Hax, Herbert and Franke, Günter, Finanzwirtschaft des Unternehmens und Kapitalmarkt , Springer, Berlin, 2003

[6] Heinhold, Michael, Unternehmensbesteuerung, Bd. 3: Investition und Finanzierung, Schäffer-Pöschel, Stuttgart, 1996

[7] Hens, Thorsten and Rieger, Marc Oliver, Financial Economics, Springer, Berlin, 2010

[8] Kruschwitz, Lutz, Finanzierung und Investitionen, Oldenbourg, München, 2007

[9] Lawrence, Stephen and Buss, Arnold, Economic Analysis of Production Bottlenecks, MPA-Volume 1, Seattle, pp. 341-363, 1995

[10] OECD/IEA, Power Generation Investment in Electricity Markets, OECD Publishing, Paris, 2003

[11] PMBOK - A Guide to the Project Management Body of Knowledge, Project Management Institute, Pennsylvania, 2008

[12] Wöhe, Günter, Einführung in die Allgemeine Betriebswirtschaftslehre, Vahlen, München, 2008

Tailoring of company internal project management standards for power plant projects

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Keywords: project management standards, tailoring, project categorization, power plant projects

Abstract: This paper presents the results of a master thesis research about the advancement of project management systems carried out at the chair of Professor Dr. Konrad Spang, Institute for Project Management of the University of Kassel. In cooperation with a German energy supplier possibilities for tailoring measurements of project management standards were investigated to suit them to different types of power plant projects.

1. Introduction

The energy sector is faced with a considerable technological development. Driven by a worldwide rising need for energy, dwindling resources and the constraints of climate change remarkable changes are taken place especially in the field of renewable energies. For instance in Germany the share of renewables on the gross electricity generation has been doubled from 10% to 20% in the years between 2005 and 2012 and this trend is going to continue [1, 2]. This kind of technological development sets new and different requirements according to project management and therewith to the scope and the applicability of project management standards. Accordingly companies in the energy sector have to adapt their approaches according to these changes to stay up to date and capable of competing. That implies amongst others to transfer best practice processes between different types of power plant projects, e.g. from "classic" power plant projects (fossil power technology) to new kinds of power plant projects (mostly renewable technologies). Therefore companies have to advance their company internal project management standards.

Company internal project management standards deal with the conflict between the company's goal of standardization on the one hand and the unique character of projects on the other hand. That means companies try to set up clear and common structures to raise their project management quality by implementing common project management standards. At the same time they risk to cause new inefficiencies by over restricting their projects flexibility with regulation. This contradiction between uniformity and flexibility needs to be balanced [3]. To ensure the required balance between the necessary flexibility for projects and the goal of standardization a specific adaption of the company internal project management standards for different types of projects and according to the specific project properties is needed.

2. State of research

Amongst others Crawford et al. [4] and Shenhar & Dvir [5] investigated types of projects. Their results show how projects differ and which kind of project categories exist. But nevertheless not much literature is available that gives direct support to companies and their project managers about how to adapt standards, processes, tools etc. to the different types of projects. This gap is shown by Bredillet et al. [6, 7]. In their work about the „Nine Schools of Project Management Research", the authors analyze the current state of project management research. They write that "research in this area can productively continue into the extensions of categorization systems of projects and the effectiveness and refinements of processes used to manage various categories of projects in different environments." [7, p. 3] Further more they identify potentials for current research in clarifying "the project management approaches most suitable for different project settings and methods for adapting the organization's existing approaches to various types of projects" [7, p. 3]. Hence the research underlying this paper concentrated on the connection of project management categorization systems with project management processes to improve the companies understanding of using optimal approaches for the given type of projects.

3. The tailoring concept

The method shown is named as technology orientated tailoring of company internal project management standards. Within the scope of this paper company internal project management standards are defined as guidelines, organizational structures, processes and methods for companies to plan, control and monitor their projects. These standards therewith are the basis for the project management system of a company [9]. The following concept is based on a given generic, process orientated project management systems that can be tailored and enhanced for different types of projects. This constraint implies that the tailoring of project management standards is realized by modifying the project processes. According to DIN 69901-2 [10] project processes are differed into two groups: a) Project management processes that contains the activities to manage a project. b) Project core processes that contain all value adding and technical activities.

The tailoring procedure shall be able to transfer given best practice processes, approaches or methods between projects and to adapt them to the given project type. To achieve these requirements a three step research approach has been chosen:

a) A new project categorization system for power plant project has been developed.
b) The correlation between project categories and project management processes has been investigated.
c) Tailoring measures based on the correlation have been shown.

Project categorization for power plant projects

Project categorization attends to identify types of projects due to their properties [4]. Accordingly projects properties have to be defined that can be used to differ projects. The analysis of present project categorization systems showed that there are two different kinds of categories:

Absolute properties: Those kinds of properties can be differed in an objective way by defined clear property variants. They describe somehow the scope of the project. The variants of absolute properties directly depend on the company's context and must be defined and modified of every company itself.

Absolute Property	**Examples of variants**
Power plant type	Cole fired power plant, gas fired power plant, onshore or offshore wind park
Project type	New build, reconstruction, extension, modification, service
Project location	Continental, nation, regional
Project ownership / funding	Internal project, external project, funding by costumer, funding by supplier
Customer / supplier relationship	Turnkey awarding, lot wise awarding

Relative properties: Those kinds of properties must be differed by comparison to other projects. They can only be measures in a subjective way and cannot be expressed in absolute values. As shown by Sapper [8] the difference of projects in those properties can be expressed by a quantitative weighing procedure. That means that the property is evaluated for a certain project on a defined scale of numbers (e.g. from 1 to 5). Defined indicators for each stage of the scale can help to make the results of a weighing more objective. Relative properties are normally more general then absolute ones. Hence their indicators do not depend that much on the company or the product as show for the absolute properties.

Relative Property	Examples of indicators
Urgency	Time frame, critical to time, impact of delays
Technical complexity	Number of work packages, complexity of task or product
Coordinative complexity	Number of involved organizations/ departments, organizational conditions
Grade of innovation and novelty	Share of innovative technology, experiences with used technology
Scope	Budget, resources, share of budget on turnover
Risk	Number of risks, probably of risks, impact of risks
Number of involved people	Team members, externals, organization
Strategic importance for company	Share of budget on turnover, stakeholders

The correlation between project categories and project management processes

The research has shown a correlation between project core processes and absolute properties on the one hand as well as between project management processes and relative properties on the other hand.

- Project core processes and absolute properties both depend directly on the company's context. As shown above absolute properties given an overview of the project scope while core processes describe how to achieve this scope [5].
- Project management processes and relative properties both relate to the management of a project. While management processes contain the management activities for the project [5], the characteristics of a project's relative properties directly influence these management activities [10].

Sapper [8] has shown that influence matrices can be used to identify independencies between two properties. This method is adapted but modified to check the influence of the project properties to the project processes as explained above. They imply the question how much the project processes $y \in \{1,2,\ldots,j\}$ change depending on a change of property $x \in \{1,2,\ldots,i\}$ [8]. The bigger the expected change, the higher is the influence of the property to the process. The evaluation can be done by using a scale between 0 (no influence of the property to the process) and 3 (very strong influence of the property to the process).

For a high level of standardization within a company it should be aspired to have one universal correlation matrix which is applicable for all projects within a given process landscape. In how far that's possible for a company has to be defined in every single case. It is recommended to execute an expert workshop with the company's project managers and experienced project members to achieve most reliable results.

	PM-Process 1	PM-Process 2	….	PM-Process j
relative P-Property 1	z_{11}	z_{12}	…	z_{1j}
relative P-Property 2	z_{21}	…	…	…
….	…	…	…	…
relative P-Property i	z_{i1}	…	…	z_{ij}

	Core process 1	Core process 2	….	Core process j
absolute P-Property 1	z_{11}	z_{12}	…	z_{1j}
absolute P-Property 2	z_{21}	…	…	…
….	…	…	…	…
absolute P-Property i	z_{i1}	…	…	z_{ij}

Tailoring measures

Based on the results from the correlation matrix tailoring measures can be defined for project management processes and project core processes. The tailoring of project management processes can be executed in a mathematical way. Therefore the results of the correlation matrix have to be normalized to one column by column. This is done by dividing every value by the column sum. The results show the properties' share of influence on a process. With these normalized values a process weight for each single management process can be calculated. The normalized values $z_{xy} \in [0,1]$ of the properties $x \in \{1,2,...,i\}$ are multiplied with the properties results of the project categorization and then summed up for one process. The result is a process weight (PW):

PW_y (PM-Process y) = [Urgency]*z_{1y} + [Technical complexity]*z_{2y} + [Coordinative complexity]*z_{3y} + [Grade of innovation and novelty]* z_{4y} + [Scope]*z_{5y} + [Risk]*z_{6y} + [Number of involved people]*z_{7y} + [Strategic importance for company]*z_{8y}

Project managers can use the PW to see which processes in their project are very important or critical so that they can pay more attention to them. Further the method allows to differ between A-, B-, C- and D-class processes. There with the classical classification of projects into A, B, C, D can be realized more detailed. For every project management process four process variants can be defined, one for every class. This enables companies and their project managers to better understand a project in the early phase so that better planning, controlling and monitoring can be achieved.

For the tailoring of core process a mathematical approach is not available. But the results of the correlations matrix helps to set up the optimal process model and to transfer processes from similar projects. The line total shows the most influencing properties. They can be defined as primary properties. On the basis of the primary properties reference process models can be defined. Those reference models can be administrated in a project process data base. The secondary properties can help to modify the reference models to suit them to the affected project. To realize such a tailoring system intensive post project evaluation and documentation is needed. Therefore post project assessments and audits should be implemented.

4. Results and Conclusion

The described research has shown an approach for companies in the energy sector to better analyze their projects. The focus of the investigation was on the correlation between project properties and project management processes. Therefore a project categorization system has been developed that differs between relative and absolute project properties. That gives a better understanding of the projects characteristics. Further a correlation between project management processes and relative properties and between project core processes and absolute properties have been shown. To determine the influence of the properties to the project processes a correlations matrix has been developed. This analyzes is the basis for the tailoring of the project processes and therewith of the project management standards to fit them to the projects requirements.

The tailoring method can further be used to gather new information for the implementation of program or portfolio management. It enables to transfer knowledge as best practice processes methods and tools between projects. Therewith a continuous improvement of the project, program and portfolio management within the company can be achieved.

5. References

[1] BMU - Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2011a) Erneuerbare Energien - Innovationen für eine nachhaltige Energiezukunft. Berlin.

[2] BMU - Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2011b) Erneuerbare Energien in Zahlen - Nationale und internationale Entwicklung. Berlin.

[3] Patzak G, Rattay G (2004) Projektmanagement - Leitfaden zum Management von Projekten, Projektportfolios und projektorientierten Unternehmen. 4. Aufl. Linde, Wien.

[4] Crawford L, Hobbs B, Turner JR (2005) Project Categorization Systems - Aligning Capability with Strategy for Better Results. Project Management Institute, Pennsylvania.

[5] Shenhar A, Dvir D (1996) Towards a typological theory of project management. Research Policy, Heft 25, S 607-632.

[6] Bredillet CN, Turner J R, Anbari FT (2007) From the Editor - Exploring Research in Project Management - Nine Schools of Project Management Research (Part 1). Project Management Journal, Vol 38, Nr 2, S 3-5.

[7] Bredillet CN, Turner JR, Anbari FT (2008) From the Editor - Exploring Research in Project Management - Nine Schools of Project Management Research (Part 5). Project Management Journal, Vol 39, Nr 2, S 2-4.

[8] Sapper R (2007) Kriterien und Elemente zum spezifischen Projektmanagement von Investitionsprojekten im chemischen und pharmazeutischen Anlagenbau. In: Spang K (Hrsg): Schriftreihe Projektmanagement. Heft 3. kassel university press, Kassel.

[9] DIN Deutsches Institut für Normung e.V. (2009). DIN 69901-5: Projektmanagement - Projektmanagementsysteme - Teil 5: Begriffe. Beuth, Berlin.

[10] DIN Deutsches Institut für Normung e.V. (2009) DIN 69901-2: Projektmanagement - Projektmanagementsysteme -Teil 2: Prozesse, Prozessmodell. Beuth, Berlin.

Project standards in utility sector

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Keywords: Standards, Framework, PMI, Project, Project type, Project category

Abstract: The energy industry has changed dramatically in recent years. So far there were heterogeneous structures in place. Now this industry is looking for standardized solutions. One of these solutions is presented here: Project Management Standards.

1. Introduction

Standards for project management are used to draw up basic processes and procedures which support the successful execution of projects. To this effect, project phases, project management processes and responsibilities are generically defined and shown along the lines of a process. The described process steps define the requirements for the planning, execution, control and monitoring of projects, starting with project development and continuing through to project completion.

Higher-level basics are stipulated by international project frameworks such as PMI (1) or Prince 2. This document briefly outlines the main contents of a project management standard and attempts to critically assess the advantages and disadvantages involved.

2. Scope of standards

The introduction of a project management standard is intended to define the associated project types and categories. The most important and relevant terms are outlined below.

3. Terms, abbreviations

Project:
A project is subject to a limited timescale and aims at creating a unique product, service or result. In its entirety, it is essentially determined by the uniqueness of the conditions involved, e.g. targets, conditions with regard to time, finances, staffing or other aspects, scope and organisation.

Project type:
A project type covers a range of projects. The project type is initially determined within the context of tailoring. At least one project type variant is offered for each project type and mandatory modules are stipulated for how to proceed. Various project features which enable optional procedural modules to be selected are allocated to one particular project type.

Project category:
The project category serves to distinguish projects in terms of complexity. Using various criteria, categories TOP, A, B and C are established. TOP projects are those with the highest level of complexity and C projects those with the lowest level of complexity. The category also indicates the minimum qualifications which a project manager or employee must have in line with the project category.

Technology (project type):
Projects can differ, for example, in terms of technology (technology & innovation projects, new-build-projects) so that the generic project management system is also focused in line with the requirements of different project types.

Technology & innovation projects:
Technology & innovation (research and development) projects contribute towards gaining knowledge about new or improved technologies or products.

Milestone:
The PMI standards define a milestone as a "significant point or event in the pro-ject".

Gate:
Gates are special milestones for project phases. They separate individual phases from each other (start and end of a phase).

Project phases:
Project phases within the course of a project depend on the field of industry or project type.

RASCI matrix:
The RASCI matrix is used to specifically allocate responsibilities to roles in pro-ject management.

Its significance is defined as follows in a project management system:

R = Responsible	**A** = Accountable	**S** = Supportive	**C** = Consulted	**I** = Informed
Person who is responsible and initiates the implementation of an activity or who performs this activity himself or herself.	Person who is accountable in a legal or commercial sense and who makes appropriate decisions.	Person who supports responsible persons in an activity by contributing work or providing operating resources.	Person who provides advice about a task to be performed.	Person who is notified about the course or results of an activity.

3. Responsibilities

The project management system should be set up and managed by a specifically appointed organisational unit. This unit ensures that the overall system is consis-tent. A process manager who is responsible for the process contents should be appointed for each process. It is this person's duty to provide the necessary level of process detail, the contents of the processes and the required documents (e.g. templates and tools), to ensure that they are continuously up-to-date and to in-clude findings for the purpose of continuous refinement. In this connection, the process manager is supported by the nominated organisational unit.

4. Description

The project management system should be realised as an integral part of the Or-ganisation Manual and its application is thus mandatory. This also includes re-quirements which focus on linear management activities but which are also to be applied from the point of view of project management. In contrast to linear man-agement activities, projects are unique in character. It is therefore important to specify precisely for each individual project just how the relevant requirements are to be implemented. This is done by compiling and releasing a separate pro-ject manual for each project.

Project phases:
The project management system should be defined by a phase model. The usual project phases are separated by intermediate results (milestones). This stage gate model enhances transparency and improves project management possibili-ties of taking action.

The relevant phases may be as follows:

- pre-development
- development
- execution
- operation

The pre-development, development, execution and operation phases are higher-level phases comprising several project phases. The development phase (pre-development and development) comprises the pre-screening, screening, concep-tual design, basic engineering, specification and tendering phases. When the main components have been tendered and the Gate 2 process has finished, this development phase can also come to an end.

Release by the Gate 2 process is followed by the execution phase which com-prises the detailed engineering, fabrication & construction and commissioning phases. For a more detailed description of the stage gate model, supplementary instructions, e.g. front-end loading and cost engineering, can be applied.

From the point of view of project management, separate initiation, execution planning, monitoring and control as well as close-out (referred to in PMI as “pro-ject management process groups”) have to be performed for each project phase. Frequently, these project management process groups are performed more than once within a phase.

5. Project processes and organization

Within the project management system, project processes are distinguished be-tween organisational processes (“project management processes”) and technical processes.

Based on PMI, project management processes are as follows:
- integration management
- scope management
- time management
- cost management
- risk management
- project quality management
- human resources and organisation management
- communication management

Core processes could include the following for example:

- engineering
- procurement and contract management
- SHE management
- site management
- commissioning management
- permitting and regulation management

In the project management system, each process is described on three levels. On the first level, all project management and core processes are listed in the overview.

The second level shows the subprocesses which are subordinated to the respec-tive process.

The third level (subprocess step level) describes the activities allocated to the subprocess. The description includes input / output, responsibilities in line with RASCI, tools / templates, interfaces, and other relevant instructions. Here again, a distinction is made between the different project types, categories and tech-nologies.

In the description of the process steps, the focus is on the question of what has to be done (based on project experience), whereas the allocated instructions show in depth how it has to be done (based on linear management experience).

A temporary project organisation is set up for each project. The internal project client appoints a project manager who then sets up the necessary project team and continuously adjusts it to the project's current requirements. The Project Management Division must be consulted by way of support and has to approve both the form of project organisation and the planned organisation chart.

It is important that, together with the project organisation, clear-cut tasks, respon-sibilities and competences are defined for project execution. In particular, coop-eration with line management units is important. Responsibilities are allocated by means of the RASCI system.

Another aspect for set-up of the project organisation is the need to adjust existing skills to the necessary competence for the project task (e.g. in line with the project category).

6. Conclusion

The introduction of a project management standard is not a universal remedy (2). In practice, there are a large number of advantages and disadvantages (see below). Despite these disadvantages, such a system offers an immense advantage for the purpose of standardising processes within a company and offering staff an important knowledge database.

Advantages:
- creation of a company-wide standard basis
- faster response to market changes
- set-up of project management
- establishment as a profession within a company
- assurance of company-internal communications

Disadvantages:
- frequent compilation of manuals which are not put into practice
- lack of visible recognition within the company
- frequently viewed by staff as being too formalistic
- high-level initial investment

7. References

[1] P PMBOK® Guide and Standards, 5th Edition 2013

[2] Lau, Carsten and other: Projektmanagement im Energiebereich, 1. Auflage: Wiesbaden 2013

Management of Organizational Change Projects in the German Energy Sector

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Keywords: Project Management, Change Management, Organizational Development

Abstract:

The article discusses the management of organizational change projects in the German energy sector. What are the changes Project Managers have to handle? How do they manage the projects for downsizing, restructuring and scaling their business? Which experiences did they gather? How important are "soft fact" topics like participation, qualification and communication?

In the first quarter of 2013 we started a series of explorative expert interviews. We contacted six managers from 4 different companies covering the established power supply industry and companies in the area of renewable energy technologies.

1 Business Environment for the German energy industry

Of course the companies in the energy industry are very different regarding their business focus and internal structures. Anyway, since spring 2010 they are in a similar situation, they have to cope with the tremendous change impact, kicked-off by the German "Energiewende". The political decision to quit the nuclear energy business irrevocably has changed the business setting completely. In the last few years, the companies have faced a need for change. In fact, there are winners and losers. The organizations are in different positions to handle the chances. While some see new opportunities, others are threatened in their existence.

"A lot of big projects have been killed in the last year. Everybody asks himself whether his job is still safe." This is how a project manager from a plant building unit of a traditional power supply company is reporting. The level of uncertainty is high. The managing director of a service company puts it quite bluntly: "Our traditional business model is no longer working. We have to cope with a fatal chord of leaving the profitable nuclear business and investing heavily into the power grid at the same time. Additionally our gas business has to digest the fundamentally changed price level in the market."

So far, in the power supply industry the effects for the employees are discouraging. The three big power companies RWE, EON, EnBW have announced major cost-cutting initiatives and substantial lay-offs. Almost 25,000 employees will have to leave in the next few years. The resizing of the companies is not well understood by the people. In 2012/13 EON and RWE were still reporting a multi-billion profit. [2,3]
This doesn't increase the level of acceptance in the staff. Instead the forced change is perceived as a threat. The main challenges for the organizational development is to re-size the internal structures while dealing with an organizational culture based on stability and security.

We found a different situation in the renewable energy sector. The need for change is not smaller. On the contrary, companies in the solar and wind energy business have to face two major challenges in the market. The competitive pressure, especially from Chinese companies, has risen in the last few years. Due to much lower production costs, the competitors from Asia were able to force down the price level in the market. While at the same time the demand in the German market is flattening. The changed approach for subsiding the private customers has started to reduce the market demand.

"This is a roller coaster business," as the Head of HR in a wind power company in the small firm sector puts it. The years of strong growth came to an abrupt stop in 2008. The dry-out in the financial markets made it difficult to invest in new installations. In the following years growth was much lower than expected. For the internal structures a time of consolidation was started. Additionally the remaining growth took place outside Germany. "We are a traditional German craftsman's business, grown up to a couple of thousand employees and faced with the challenge to manage our international customer base globally." The main task for the organization is to align internal processes and to qualify the staff for the change business environment.

These market forces have become almost lethal in the solar energy industry. The German solar energy companies are in a very uncomfortable situation. In the golden years between 2000 and 2008 they grew enormously, driven by the publicly financed demand boom. The number of employees in the solar energy industry exploded up to 130,000 in 2011. Almost everybody in the industry built up excess capacity. At the same time they neglected investment in R&D. In Germany today, we have a lot of oversized solar energy companies with a substandard portfolio of product innovations. Since 2011 the demand is drying out and the price is falling. The consequences for the companies are highly visible in the newspapers. In 2012 alone more than 30,000 people were laid-off. Pessimistic estimates believe that almost 70% of the companies will have to leave the market within the next 5 years. Today, organizational development projects mean to increase efficiency, re-sizing and re-locating. [4,5]

2 Conceptual approach for integrating project and change management

Organizational changes can be managed as projects; they are temporary endeavours with clearly defined objectives. The addressed organizational change is a unique, one-time activity; this means that the uncertainty about how to get there and the risk of missing the target are high. Modern project management provides a well proven framework for planning and controlling tasks like this.

In the energy industry projects are well established as a form of working. Project management is applied intensively for managing engineering projects. Project managers are trained and experienced in tools and techniques. Traditionally these projects are focused on "hard facts and mandatory dependencies". The more soft fact oriented issues like communication, qualification and participation are normally not central for delivering project success. This is changing. The massive organizational remodelling has increased the need for managing the people side of change.

Managing organizational change is aimed at supporting organizations, teams and individuals by implementing structures, processes and behavioural routines in the organization. To implement means to ensure the acceptance and the application of the changes on a social and psychological level. Modern change management provides methods and approaches for designing and accompanying change processes. [1,6,7,9]

Change projects follow the classical project management circle of initializing, planning, executing and close down. [8] The main management tasks are described as project assignment, project baseline and project governance structure. For organizational changes a life circle concept can be described. The phase concept is based on an iterative, cyclical approach to manage organizational changes in a step-by-step fashion. [10] (Abb. 1)

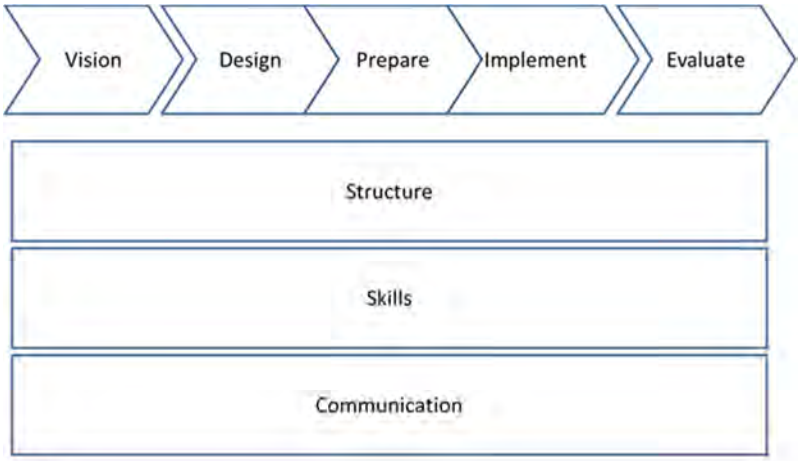

Abb.1

- Vision – the change-initiative starts with the definition of the organizational vision. This covers the fit between strategy, environment and the main organizational design dimensions. Basically the management has to answer the questions: Why do we have to change? What do we want to achieve?
- Design – the specification of the relevant organizational design dimensions is set up. This may cover different scenarios and is based on an iterative process. It gives a clear picture of what will change and how the organization plans to get there. Essentially it covers design elements and communication issues alike. It is a holistic approach for describing the change roadmap.
- Preparation / Implementation: now the executing is started. Materials for training and communicating are set up, multipliers and managers are prepared. The design elements are rolled out. All necessary activities and deliverables for "going-live" are managed.
- Evaluation - one of the challenges of organizational change projects is that it might take some time before the intended positive consequence can be observed. The evaluation means not only implementing ongoing checks for making sure the project is on track. Additionally the evaluation has to monitor the long-term effects of the new organizational set-up.

The CM life cycle describes the basic phase of the project. Additionally different work streams can be used to describe the required activities and deliverables:

- Structural development – organizational changes are based on a clear definition of the organizational structure, role definitions, reporting lines, performance lines and more. These tasks can be planned and controlled based on work packages and deliverables.

- Skill development – for employees a new organizational structure brings new roles and tasks. They have to learn new skills and develop the required competencies. This is an HR issue and is normally rather a long-term task interfacing with daily HR business. In the project plan this is often handed over to experts from the line organization. The

monitoring is also carried out in more HR-specific way, taking care of individuals and long-term development goals.

- Leadership and Communication – successful organizational change projects are able to deliver not only the required deliverables. Additionally stakeholder acceptance is ensured. The main challenge is to communicate properly with the impacted stakeholder groups. One basic tenet of change management is to offer participation, which means to involve the impacted persons. This is a leadership issue and requires open communication about objectives, procedures and reasons. In the project plan this is not easily addressed by work packages and hard dependencies. A more iterative, open approach is required. Often concepts like maturity levels and stages are applied to describe and follow-up the "soft" side of organizational change.

3 Status Quo

How are companies handling the need for organizational change today? Are managers willing and able to address the people side of change in a professional way? How are project management and change management linked in management practice?

Management of Project Portfolios – considering organizational change aspects

Companies are challenged by external pressure to adapt to changed market conditions. While companies are pursuing different strategies, there are some typical patterns in the different sectors of the energy industry. In the companies from the traditional power supply sector, an atmosphere of loss and insecurity is often prevalent. This also shapes the management attitude and actions. A different mood can be found in the companies of the renewable energy installation and production business. Overall, they have started to seize the opportunities of the new market constellation.

"The announcement of massive staff reductions hit us by surprise. Afterwards, almost nobody was interested in the daily project business. Everybody started to position himself for the new organizational setup," reported a project manager from the plant building unit of an energy provider (Energieversorger – EVU). An atmosphere of "duck and hide" took place. A tendency to avoid risks and delay decisions made the daily business difficult.

A different observation was described in those companies contacted in the solar & wind energy industry. The employees are much more familiar with changing conditions. From the start-up years, they are used to working in a highly dynamic environment. Furthermore, the culture of flat hierarchies and lean processes is creating a more open and agile company culture. This supports a more opportunity-oriented discussion of the situation and a higher willingness to take risks.

No matter which part of the industry, none of the contacted companies applies a systematic approach for identifying and analysing change projects. There is no portfolio-oriented approach for managing and coordinating organizational change activities. The companies are following a more re-active approach and start to address the people side only after resistance by the employees has become critical.

This management practice has at least two major drawbacks. Firstly, the companies are missing the benefits of a coordinated portfolio. Synergies might be lost and conflicts evolve in an uncoordinated, potentially harmful way. Secondly, organizational change projects are

competing not only for resources and time. Even more challenging, change projects draw attention away from the daily business. This effect may harm the operational performance substantially and also reduce the motivation of the staff in the long term. A coordinated, portfolio-based approach can help to avoid these unintended effects and keeps the organization agile.

Planning and executing change projects

All interviewed experts reported about a strong project culture in the companies. The management tasks of planning and controlling are performed reliably and with a sufficient level of professionalism. Well-proven tools such as assignments, breakdown structures and performance indicators are systematically deployed.

A completely different picture is found in the area of communication and participation. None of the contacted project managers was aware of any defined or actively managed communication strategy in project work. In reality, stakeholder management was carried out in very re-active way, only when the pressure started to rise. In general, the lack of a clearly-defined communication plan makes this a very exhausting and unpleasant activity. One project manager puts it bluntly: “Change management – nobody wants to do this job!”. [3,4]

The project management guidelines of the contacted companies do not give any advice or support in managing the change issues. How to set up a communication plan? How to define a skill development strategy or how to align the leadership style with the change scenario? The project managers are on their own in handling these tasks. Not surprisingly, an effective implementation of change initiatives is perceived as a rare exception in the companies. Today, project management practice in companies has a blind spot regarding change management.

At operational level, the project managers become more and more aware that “soft factors” are critical for success in managing change. The teams start to invest time to develop a common understanding about risks and opportunities of social issues. Experiences and lessons learned are collected on how to foster awareness and acceptance, how to involve the impacted and organize participation? How to run an effective and efficient communication campaign? Gradually, internal networks of experts are established to share findings and best practices. Overall, the teams are willing to try new approaches and to learn about change management. More and more, they start to apply more experimental settings from the world of theatre and music.

One challenge is to make sure that “repercussions” and feedback in the organization become visible: fast, reliable and in an efficient way. “We are very interested to learn about how the kicked-off changes are perceived by the impacted colleagues,” says one project manager involved in a process roll-out initiative. Established communications formats such as conferences, market-place settings and networks of experts have become so common that it is difficult to trigger the required reflections on a social and psychological level. New approaches based on large-group settings such as World Café and Future Conference are used. But also more cost-efficient approaches based on Web 2.0 technologies have become part of the communication toolbox in the companies. Very clearly, the change experts in the organizations are fighting for the necessary attention with creativity and innovations.

Unsurprisingly, the lack of planning in the soft fact area has negative consequences in the execution phase as well. In times of budget-cuts and reprioritizations, activities that are not explicitly planned have a hard time surviving. Almost every contacted project manager talked

about the exhausting task of securing budgets and resources for communication and participation. Reduced travel expenses, massive cuts in training and qualifying measures, overall hard-fact oriented discussions about productivity and efficiency make it very difficult to run the necessary change activities. The blind spot in project plans has become an open-pain point in the execution phase. Today, change management has a low priority on the management agenda.

Participation and Communication

Traditionally, the German EVUs have a strong culture based on stability and security. This is fundamentally manifested in the mentality of managers and employees. “The majority of our managers are mainly interested in perfectionism and permanence. They defend the status quo, avoid risks and are basically in re-active mode.” This is the appraisal an EVU manager gives to his management peer group in a large EVU company. He is also concerned about the slow-motion mode which makes decisions difficult and decreases desperately required business agility.

Overall in the contacted EVU, the management is focused on numbers and “hard facts”. Strategy and execution are linked by the management-by-objectives framework which emphasizes quantitative objectives and performance indicators for controlling. Soft facts are not covered in the score cards with the same rigour as the head count and productivity. Furthermore, the basic communication mode is top-down and runs through the complex management hierarchies. More participating styles of collating and distributing information are not part of the organizational set up today.

Again, we found a different situation in companies of the renewable energy business. Generally, the companies are smaller and on average younger. They have a strong identity formed in the start-up years of growth and financial success. Hierarchies are flat, the processes overall leaner, a more decentralized, participatory style of communicating has been implemented. This has consequences for the management mentality. “The ability to communicate with colleagues on different levels is a must for every manager in your company. We assess this carefully when hiring new people.” Afterwards, the managers take part in development programs which address these leadership competencies. Coaching, networks and feedback sessions are in common use.

4 Change Management as a core competence

At which point are the companies today? The interviews with managers from projects and line departments represent only a very limited view of the status quo in a diverse industry. The comments are subjective and of course do not allow generalizations for the whole sector. Nonetheless, a first impression which may support future research activities can be formulated based on the discussions.

- The “Energiewende” is forcing companies to change. The better they are able to re-position themselves in the changed business environment the more likely they will be able to exploit the opportunities of this market. This change requires not only new products and processes, they also need a company culture which allows and fosters organizational change. The “People side of change” is a basic ingredient to becoming and remaining agile. Today, companies have a low cultural awareness of this. While the traditional EVUs cling to their core values of stability and status quo, the companies from the renewable sector are trapped in a mentality of reaping state subsidies and

living in unsustainable market structures. This cultural misfit between internal structures and external challenges is threatening the long-term viability of the industry.

- Managing change is a core discipline in modern management. Being aware of, and being able to manage, “the people side of change” is a must in every industry which is confronted with a global and dynamic market. Compared to companies in telecommunications or aviation sectors, which digested this challenge a couple of years ago, the power generation industry is in its early phase. The change topic is at the bottom of the management agenda and the operational performance is substandard in terms of maturity. This lack of alignment of the internal skills map may harm the competitive position of the companies. The ability to motivate people is a critical success factor.

- Time is critical! It not only takes time to improve business agility; even more critical, bad change management is demotivating people in the long term. There is no quick-fix for restoring trust and support once it has been lost. Today, the value of a motivated work force and a strong corporate identity does not seem to have top priority in the management discussion. The experience from other industries is quite obvious; business agility is built on company culture. Some companies have learned this the hard way.

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References

1. Claßen,M. (2008) Change Management aktiv gestalten, Luchterhand, Köln
2. Die Zeit vom 27.12.12 “Schwäbisches Bubenstück”
3. Frankfurter Allgemeine Zeitung vom 21.12.2012 “EnBW streicht 1.350 Stellen”
4. Frankfurter Allgemeine Zeitung vom 3.1.2013 “Die Solarindustrie in der Zwickmühle”
5. Handelsblatt vom 14.12.2012 “Vom Saulus zum Paulus”
6. Hiatt,J. Creasey,T. (2003) Change Management – the people side of change, Prosci Learning Center Publication, Loveland Colorado US
7. Königswieser,R. Exner,A. (2004) Systemische Intervention, Klett-Cotta, Stuttgart
8. Project Management Institute, Inc.: A Guide to the Project Management Body of Knowledge (PMBOK Guide). PMI, Newtown Square PA (USA) 2013. 5. Auflage.
9. Prosci (2012) Best Practices in Change Management – 2012 Edition;
10. Stanford N., (2007) Guide to Organisation Design. The Economist, London

Multi Project Management in the Utility Sector

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Keywords: Project Management, Multi Project Management, Project Portfolio Management, Utility Sector

Abstract: The article "Multi-project Management in the utility sector" describes the structure and functions of multi-project management in general and a concept of the structure for the utility company in special.

Furthermore a description of the implementation of a successful multi-project management system will be provided.

After an introduction, the terms and definitions as well as the benefits will be explained. The article is structured in the dimensions "methods and processes", "organization", "people" and "IT" as well as the link to the company strategy. The tasks and main characteristics will be described and an application in the utility sector will be shown. The article will close with the implementation of multi-project management within a company.

1 Introduction

Based on the changing environment and the flexibility in the utility sector a new organizational working approach is becoming more and more important.

Project management is a critical success factor for utility companies in the last years (cf. [1]). The competence to organise and manage important and temporary endeavour as a project increases the quality of deliverables as well as the motivation of the employees. This leads to an increase of efficiency of the whole company.

Apart from the single project management (SPM) the Multi-Project Management (MPM) approach is playing an important role. The main goal of the Multi-project Management is it to start the right project at the right time and to avoid resource conflicts.

But the introduction of project management (Single-project Management and/or Multi-project Management) leads to organisational changes and therefore to fears and reluctance of the employee side. Therefore a professional change management is crucial for success.

Many companies have put a lot of effort in the development of the Single-project Management. In most cases the successes of the projects regarding scope, time, and budget have increased. But there is still a lack of potential, which is not exploited (cf. [2]).

The goal of the Single-project Management is the improvement of cost, time and quality of a single project. The goal of the Multi-project Management is improvement of the economic and strategic company situation as such.

2 Status quo and the relevance of Multi-project Management

In 2008 a research of the IDC, in which companies of different branches were questioned regarding their experience about the implementation of Multi-project Management has shown a positive impact of project portfolio management (cf. [3]):

- The number of project which were performed simultaneously increased by 25%
- At the same time the cost decreased by 37% at an average
- The amount of failed projects dropped by 59%
- Redundant projects could be fostered by 78%
- Only half of the project overextended the budget in comparison to before using Multi-project Management solutions
- The quality of the work performance increased and for the execution of project averagely one third less time was needed.

An additional research of the Technical University of Munich from the year 2007 verifies that many companies are aware of the benefit of project portfolio management but hesitate to implement project portfolio management (cf. [4]).

- 45% of the top managers know about the strong impact of project portfolio management on the business success but...
    - Only 12% of the companies execute the right amount of projects
    - Only 19% of the companies stop unnecessary project consequently
    - Only 23% of the companies split the resources in line with the strategy
    - 32% complain about double work effort

3 Defining the terms Multi-project Management, Program Management, and Project Portfolio Management

The definitions and terms of Multi-project Management are actually not applied in a consistent way in theory and praxis. Therefore a brief overview and definition of the main terms is required and shown in this chapter:

In order to delimit the different terms the following chart delivers an overview.

Figure 1: Definition of Terms

Concerning DIN 69901-5-2009 **Multi-project management (MPM)** is the organizational frame for conduction of a variety of single projects. The co-ordination of the resources for these projects is part the Multi-project Management. (cf. [5]).
The Multi-project Management consists of a project portfolio management as well as the whole project management system incl. processes, standards, key performance indicators, templates, rules, IT solutions, competence development, etc. (cf. [6], p. 58 ff.).

A bundle of projects with the same goal is called a **Program. Program Management** is the planning and controlling across of a bundle of projects with the same goal. (cf. [6], p. 22 ff).

Project portfolio management is the permanent planning, prioritizing and controlling of a variety of independent projects of one unit and/or the whole company (cf. [6], p. 23).

The main tasks of the project portfolio management are the planning and controlling of the project portfolio, with the following activities:

- Defining and prioritizing of projects and programs to realize higher organizational or company goals
- Evaluation of requested projects
- Permission, postponement, and rejection of project requests and change requests of running projects
- Continuously supervision of running projects (project progress, budget, risks, resources, and dates) in the company view
- Solutions for conflicts in several projects regarding targets, dates, resources, and budget

4 Comprehensive Multi-Project Management Approach

For a goal oriented and successful Multi-project Management it is crucial to have an integrated and comprehensive approach with the dimension

- People
- Methods and Processes
- Organization and
- IT.

It is important to know that Multi-project Management is not a static organizational structure but a dynamic approach with continuous improvements.

These dimensions are the “adjusting screws“ which you have to screw in order to implement a successful Multi-project Management.

Apart from these four dimensions, the consideration and the linkage to the company strategy is crucial as the strategy has a direct influence to the project portfolio and therefore to the selection of projects.

4.1 Dimensions Processes and Methods

The basis for Multi-project Management solutions is a standard project portfolio management process. Due to the company specific extension and integration of these processes in the existing processes variety, the methods, the organization, the IT, and the requirements on the performing people are worked out.

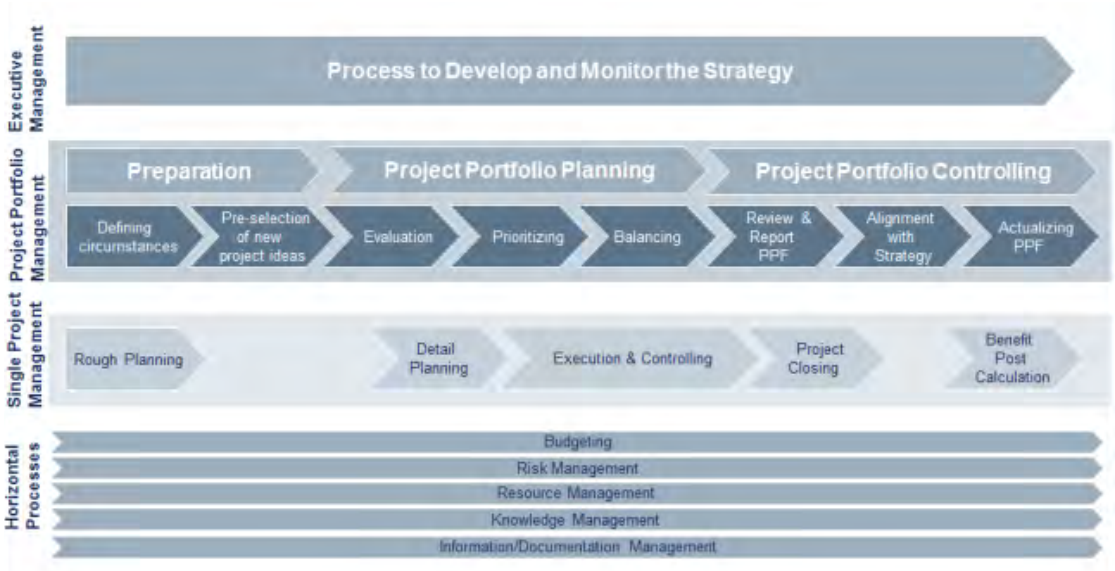


Figure 2: Standard Process of Project Portfolio Management

The project portfolio management process has to be involved in the business processes of the company. The following business processes have to be considered:

- Budgeting (annual planning, accounting, controlling, forecasting)
- Risk management (risk consolidation, risk communication, allowance)
- Resource management (capacity planning, personnel development, connection to work council, working times, incentive systems)
- Knowledge management (securing of experience)
- Information management (regulations for documentation, labelling, archiving)

4.2 Dimension Organization

For the project portfolio management a permanent organizational unit has to be set up in the company. In general this organizational unit is called the Project Management Office (PMO). This PMO is reporting to the portfolio steering committee (decision-making authority) and usually has besides the portfolio planning and controlling the following two main tasks:

As PM competence centre it is responsible for the permanently development of PM methods and the PM organization. The PM competence centre serves as a company internal know how centre for project management and exists as executive department of employees with expert knowledge about project management.

As PM service centre it is both responsible for the operative support of the complete PM organization for the application of PM methods and their tools in the form of trainings and coaching as well as being a technical contact person for PM methods/tools.

For hierarchical project portfolios several PMOs with defined decision authority are established. The tasks, competencies and responsibilities of the PMOs distinguish regarding the hierarchical level and/or the centrality (central vs. decentral). The highest / central level can be seen as strategy and structure defining entity for the project management. Most the time the decentral PMOs are focusing on the support of programs and projects with PM resources as well as templates, process descriptions. The following figure shows an example of the construction of a power plant.

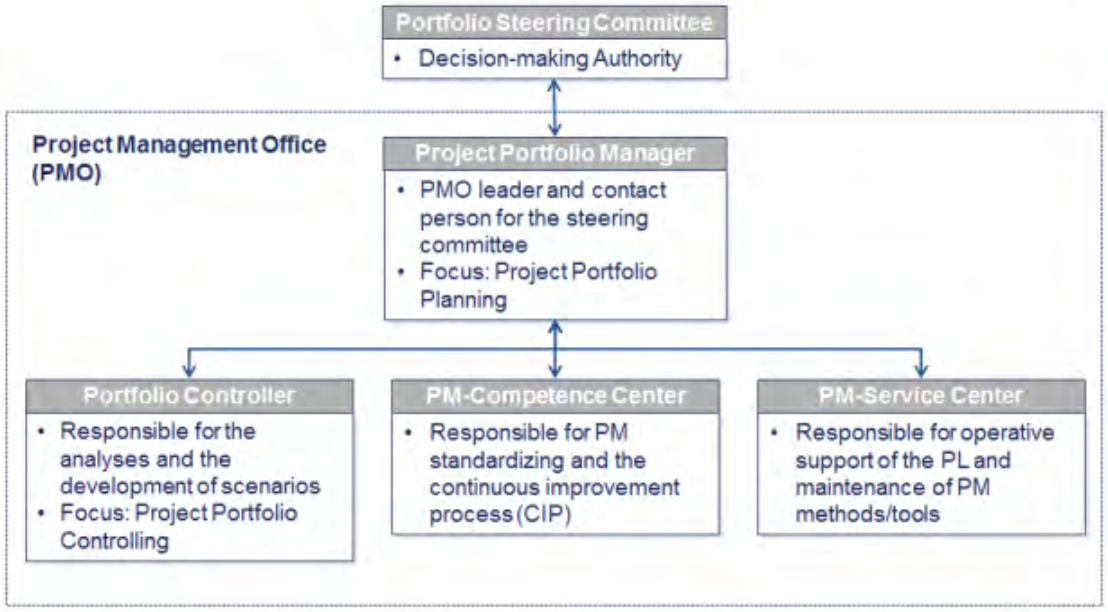


Figure 3: Structure of a Project Management Office

4.3 Dimension People

In order to get qualified and motivated employees for the tasks and functions of project portfolio management, these functions have to be designed attractively. This can be achieved by realizing the following steps:

- Accordingly high organizational mounting of the project portfolio organization,
- To embed the roles of project portfolio management in the career model of the company,
- To offer training opportunities,
- To define opportunities for development both in the direction of line responsibility as well as in the project leading, and
- To define authorities and scope for action.

The project portfolio manager is a “sparring partner“ for the management regarding the planning and controlling of the project portfolio as well he is in a frequent agreement with the line managers and project leaders. This requires an appropriate standing in the company and a wide range of experience background of the project portfolio manager.

4.4 Dimension Software

The last but most necessary step to guarantee the sustainability of the solutions is to integrate a software solution for the project portfolio management in the existing IT landscape. After the processes, the methods, the organizational implementation, and the qualification of the participants (potential users of the IT solutions) are defined, the appropriate IT solution will be designed and implemented based on these requirements. Respectively to these requirements unique software solutions can be designed or a on the market existing one can be implemented.

The granularity and distinctness of several functional modules varies to each segment. In general for each software designing it has to be defined if the single project management and the multi-project management are to be administered together in one system environment or not.

The advantages and disadvantages of both architecture approaches have to be weighed against each other.

5 Application of Multi-project Management in the utility sector

This chapter shows the particularities of project management in the utility area. Furthermore the benefit of Multi-project Management will be derived.

Based on the three types of projects (customer projects, internal projects, Research and Development projects (R&D)), there are mainly for the customer projects segment specific differences.

These differences are also existing in the dimension „People“, „Methods and Processes“, „Organisation“, and „IT“.

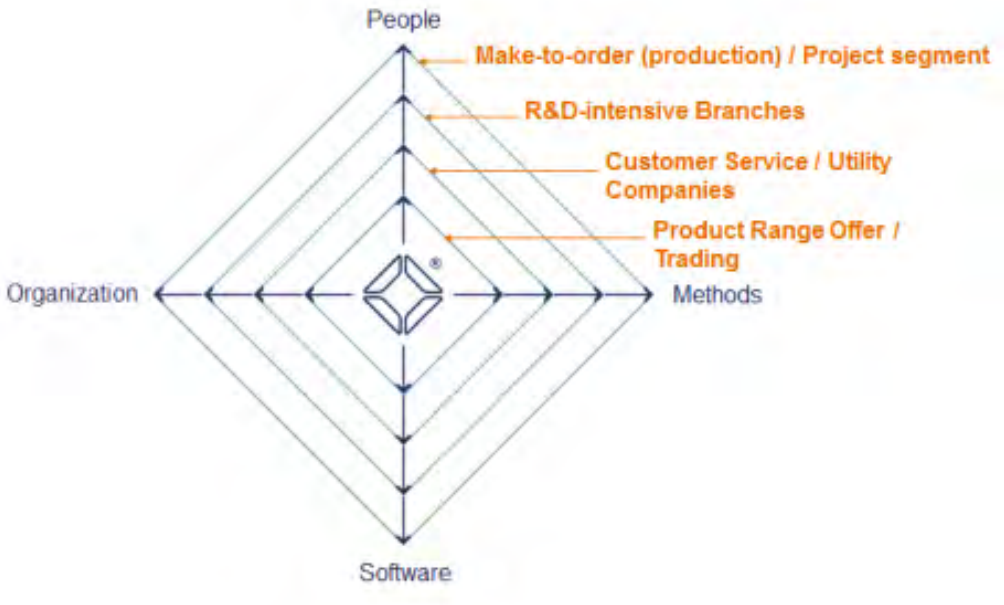


Figure 4: Project Competences in different Branches regarding the four Dimensions People, Organization, Methods, and Software

The main tasks of companies within the utility sector are the generation, the distribution, and the trade of energy. Thereof the generation and distribution have the biggest part of the value chain. These part of the value chain are characterized by big projects of construction, maintenance, and deconstruction of power plants.

Therefore the utility company, particularly energy suppliers, are in the area construction / Project business. Thus they are at the most complex level of project management. The high demands on project management are in the area of Single-project Management and Multi-project Management.

The client projects in the utility sector can be categorized in new construction projects (categorized regarding technology, e.g. gas, coal, renewable energy forms (wind energy, photovoltaic, and biomass)) and according to the contract type (plumb projects or general contractor projects), asset projects, grid projects IT / TC – incl. Smart Metering and Smart Grids.

- New construction projects
    - Technology
        (a) gas,
        (b) coal,
        (c) renewable energy forms
            (i) wind energy
            (ii) photovoltaic
            (iii) biomass
- Contract type
    - Plumb projects
    - General contractor projects
- Asset projects
- Grid projects IT / TC
    - Smart Metering
    - Smart Grid

The largest amount of projects is technological and required by law (so called must-projects).

In the development of project portfolio in several big energy suppliers which are operating internationally, a hierarchy project portfolio structure was evolved which is based on the organizational structure, e.g. power plants – business unit – mother company.

The typical characteristics which gain importance through the above described project management with its four dimensions, of energy suppliers are:

- Each major project needs a type of project portfolio management
- A very long project duration and a very high volume (several years and billion Euros of budget) and therefore a very big project team
- Several sub-suppliers which have to be coordinated
- Order-related single production/manufacturing
- Individual project closings
- High share of project dependent costs and services

The essential success factors for the project business in this branch are planning security - due to extreme high investments, project management as elementary core competency, excellent project controlling, elaborated risk management, claim- and contract management without any leaks, as well as a project oriented organization, structure, culture, and processes.

Under consideration of the above mentioned features of energy utility companies the project portfolio management is able to provide the following points:

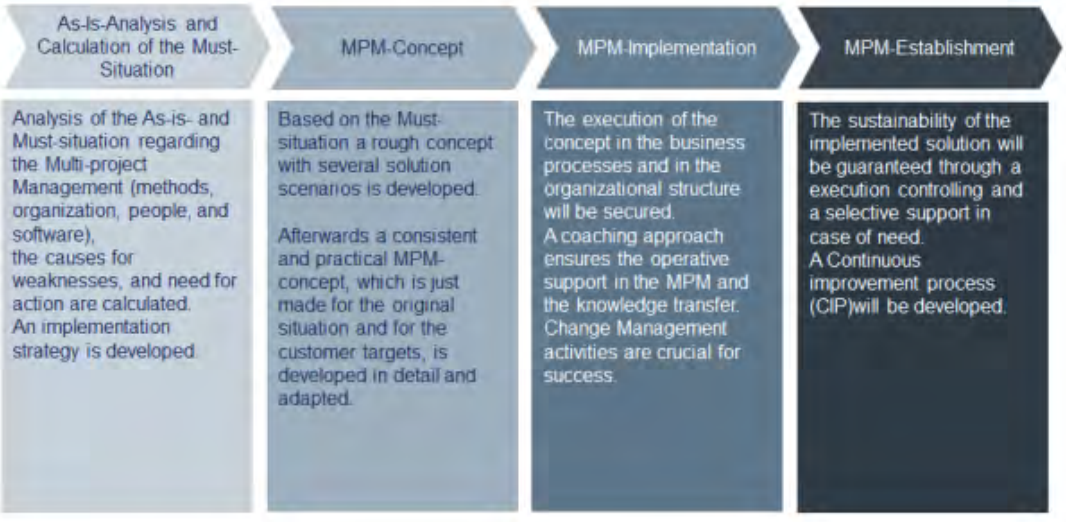
- Through clearly defined strategic and economic defaults concerning Bid-No-Bid decisions and the following contract signing the composition of the project portfolio will be optimized sustainably.
- Through a demand-capacity alignment it is secured that the necessary resources for the project are available and therefore the project is executed within the budget and time frame.
- A standardized project portfolio controlling guarantees that changes are recognized premature and actions are initiated.
- The gained transparency in the planning and controlling about the project portfolio protects the usage of existing synergy potentials.

This leads to a lasting increase in the turnover, decreasing costs, shorter cycle times and improved liquidity.

To successfully implement a project portfolio management in energy utility companies and to permute the above mentioned success factors, in the following chapter a successfully applied approach is described.

6 Concept of the implementation of Multi-project Management

In order to secure a successful implementation of Multi-project Management, you have to set-up a strategic project with clear phases and milestones. At the end of each phase there are well



defined objectives and deliverables and there should be a freedom of decision, whether and how the next phase will be designed. Thus, there is at each step in the project the guarantee concerning transparency and a check point for the actual requirements of the company (cf. [7]).

Figure 5: Process to Implement and Establish Multi-project Management

7 Results and Conclusion

It is demonstrated that companies which apply project portfolio management gain higher profits from their project investments and secure through the controlling that their projects contribute a specific part to achieve the company targets.

The essential benefit of project portfolio management is the creation of transparency in the choice of the optimal project mixture in connection to the contribution to the company targets and the strategic requirements. Furthermore synergies between projects will become transparent and are able to be used which lead to a higher productivity of used resources in most cases. The improvement of the project results (adherence to time and cost limits and results) through a consistent risk management and a prompt reporting can be achieved as well.

Especially in the project intense energy branch project portfolio management is able to contribute a valuable contribution to achieve more effectively the strategic targets and the project targets. Thereby the following success factors should be considered:

- Establish the topic in the top management level (e.g. establishment of the steering committee)
- Implementation of a project portfolio management as an own project
- A professional stakeholder management (integration of relevant stakeholders)
- Internal communication suitable for the target group
- Client specific and regarding the starting situation and objectives development of an appropriate solution
- Realization of quick-wins to quickly prove the feasibility and the benefits of the targeted solution
- Measurement of the sustainable success of the project portfolio management
- Holistic balanced project portfolio management solution
    - Integrated project portfolio management processes in the existing business processes
    - Established project portfolio management organization
    - Qualified and motivated PMO team members
    - Efficient and “relieving” IT solution
- Strong connection to the company strategy

8 References

[1] T. Peters, The Circle of Innovation: You Can't Shrink Your Way to Greatness., New York : Vintage, 1999.

[2] Tiba, „Multiprojekt- und Portfoliomanagementmanagement (Tagungsunterlagen),“ München, 2010.

[3] R. Perry und E. Hatcher, „How project and portfolio management solutions are delivering value to organisations,“ IDC White Paper, Doc # 213980, 2008.

[4] B. Friedrich, „ Einzelprojekt- und Projektportfoliomanagement als Grundstein wirtschaftlichen Erfolgs,“ *Tiba Magazin Ausgabe* , 3 2010.

[5] D. 69901-5-2009:, *Projektmanagement - Projektmanagementsysteme - Teil 5: Begriffe.*

[6] G. Lomnitz, Multiprojektmanagement: Projekte planen, vernetzen und steuern, Landsberg/Lech: Verlag Moderne Industrie, 2011.

[7] A. Dechange und C. Lau, „Effiziente und erfolgreiche Implementierung von Projekt Management Offices,“ in *Handbuch Multiprojektmanagement und –controlling: Projekte erfolgreich strukturieren und steuern*, C. Steinle, V. Eßeling und T. Eichenberg, Hrsg., Berlin, Erich Schmidt Verlag, 2010.

Designing an AIS-based communicationinfrastructure to enhance security and navigation in seafaring as an example of solving real world problems in an IT-project

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Keywords: Automatic Identification System, maritime infrastructure, IT-project, navigation, seafaring

Abstract: This paper deals with the design of a maritime and land-based communicationinfrastructure and its associated technologies. In seafaring it is not possible to track precise and fine-grained real-time weather data while on water. The refresh period of weather data and the coverage of the already existing weather stations on seas are insufficient. In addition, for non-commercial seafaring vessels, there is little or no reliable information on depth for many regions. These issues can compromise security and safety in open waters.

In this paper, the very high frequency (VHF) based AIS-technology will be described shortly. Based on this the concepts of our newly developed infrastructure will be introduced as an example of how real world problems are going to be solved in an IT-Project. The new infrastructure allows us to determine correct depth and real-time weather data, and to send these data to a land server for further processing. This is possible through the links between an on-board server and the land-based server.

1. Introduction

There are various electronic devices aboard a ship that support navigation and security. At the same time, the number of different internet platforms is increasing. Mobility of devices, the worldwide access to the internet and many advanced server systems bring the capabilities for communicating and transporting data between vessels and land-based stations.
A few companies identified these issues and developed internet-platforms to receive specific weather data for seafaring. However, to observe these data in real-time and without any internet connection is not possible. The company Oceansweather [1], which was founded 1977, offers an internet service for observing the worldwide maritime weather situation. The National Oceanic And Atmospheric Administration (NOAA) developed an additional web application [2] that lets the user analyze the weather situation in greater USA and its coastal areas. Finally, the company SVB GmbH [3] from Bremen developed the online platform Portmaps [4]. Hence, the user is able to check the worldwide weather on seas through a Google Maps layer.

Latest weather information is essential in seafaring and has to be observed constantly. The weather situation in open waters can change immediately and lives are threatened in the worst-case scenario. Accurate, reliable and current information about the weather on the course of a ship has to be accessible for seamen. Specific weather stations are installed on buoys that send

the latest weather data of their region to a server on land. The buoys coverage on sea is coarse grained; therefore the collected weather data is not precise enough.
Also, existing online services deliver non real-time weather data. Therefore it is only possible for a skipper to check the weather before going out to sea. Moreover it is not possible to observe real-time weather data while in open waters. Finally, there exist no devices or chart plotters that are able to visualize the weather data.
The depth data is another significant factor for the security in seafaring. This information is measured by the so-called water departments. A waterway is an area on a river or near coasts where commercial vessels can pass through because of the adequate depth of water. The depth of the waterways is measured by the water departments regularly. The boundary areas of the waterways are designated for non-commercial vessels, whereby the depth of these areas is not measured often and fine-grained by the water departments. As a further consequence non-commercial vessels may not have any depth information in a specific region on sea.
The low refresh-period of the depth data and the issue of missing information in relevant boundary areas reduce the security in seafaring.

2. AIS-Technology

The Automatic Identification System (AIS) is a widespread information system that should enhance the security and efficiency in seafaring through its extended information transfer [5]. It is a requirement for commercial vessels since 2004 [6]. The AIS is based on the very high frequency (VHF) maritime radio. The primary function of this technology is to improve navigation in open waters, avoid possible collisions of vessels and enhance the data and information transfer between vessels and AIS-capable objects.
A vessel endowed with AIS sends continuous information through an AIS-transmitter about its own situation via the VHF maritime radio. This information includes for instance the current position, speed, navigation status, weather data or the name of the sending vessel. Other AIS-capable objects that are close to the AIS-transmitter in a radius of 60 nautical miles can receive the transmitted data record [7]. Depending on the used Hard- and Software on board of the receiving ship, the received data can be monitored for example in a notebook. Therefore extended Information can be exchanged between ships, buoys and other AIS-capable objects like land-based AIS-stations.
It is important to mention that this technology cannot replace the well-known Radar system [8] because AIS is only able to detect transmitting and active AIS-objects. However, the Radar system identifies inactive objects on seas like rocks or coastal regions [8].

3. The Approach to develop the communicationinfrastructure

The insufficient quality of the obtained weather and depth data and the consequent low security in seafaring was the key factor to create a communicationinfrastructure that enhances the security and navigation. Therefore in this IT-project we created a solution of a real-world problem.
To identify the needs in this domain, the functional and technical requirements needed to be defined in the first phase of the project. Having a course-grained overview of the requirements, a functional specification document was created that defines concrete requirements to the system and gives legal security to the developers of what needs to be implemented for the client. Based on the requirements we designed the technical aspects of the communicationinfrastructure that needed to be implemented. Figure 1 illustrates the designed infrastructure and the participating ships and stations in an UML diagram.
We came up with the solution of developing two components that result as the major components of the infrastructure. An on-board unit, installed and operating on a vessel, collects weather and depth data from sensors installed on the ship. The data is transported via the NMEA-protocol [9], so the board-server can receive the data through an NMEA-interface.

Once the on-board unit receives the weather data, it forwards the information via Ethernet to the AIS-Transmitter. Thereafter, the transmitter sends the collected and current weather information of the ships region to surrounding AIS-capable objects. Already existing AIS-land-based stations, which are based at coasts, belong to the AIS-capable objects and can also receive the transmitted data from seas. The receiving objects can then monitor the weather conditions of the

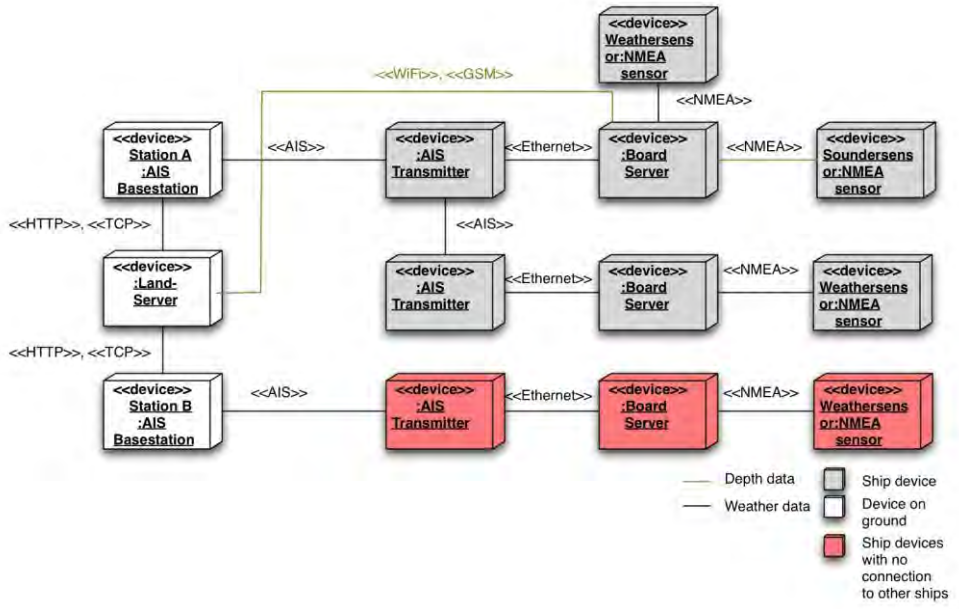

Figure 1: The designed communicationinfrastructure

sending vessel on a mobile device or laptop in real-time. If vessels are not in the surrounding of the sending object and are therefore unable to receive the data, there is another way of receiving this information through the second important component, the land-based server. This server receives the transmitted data from an AIS-land-based-station via HTTP and TCP-protocol. The AIS-land-based-station is located in the same region as the sending ship and received the weather data via AIS. Furthermore the land-based server forwards the weather data to another AIS-land-based-station that is in the same region as the vessel, which cannot receive data from other AIS-objects. The AIS-land-based-station sends the data finally to the distant AIS-object. In figure 1 the red colored components represent a vessel with no direct AIS-connection to other AIS-objects. In this manner the distant vessel is able to monitor real-time weather conditions of ships that are based in other geographical regions.
Regarding the depth data, the on-board server saves the measured data during a ship journey until it can connect via Wi-Fi or GSM to the land-based server. Once the connection is established, the depth information and the corresponding GPS-data are sent to the land-based sever, which archives the measured data. The GPS-data is measured through a specific GPS-sensor installed on the vessel. The green colored connections in figure 1 visualize the transportation path of the depth information.
In addition, a web interface mediates the access to weather and depth information through a web-connection to the land-based server. Thus users can use mobile devices or any other internet-capable computer to check weather and depth conditions in specific regions.

For the whole project-life-cycle including the implementation, we realized that agile project methods [10] i.e. scrum [11] need to be applied. In this way, additional changes of the requirements can be applied easier, work processes are more flexible and the team-members are able to learn new aspects of project management from the current project.

4. Results and Conclusion

The existing and established technologies to measure weather and depth data are not sufficient to provide high security in seafaring. Weather data can be gained via specific internet platforms, however real-time weather conditions cannot be monitored offline. Also, there is little or no reliable information on depth for many regions on seas.

Therefore we decided to expand a concept to enhance the security and navigation in open waters. We presented our designed communicationinfrastructure, which is based on the AIS-technology and is composed of an on-board unit and a land-based server system. Through the resulting collaboration of the vessels and the AIS data transfer, real-time weather data can be observed. Through the collaboration with already existing AIS-land-based stations, the land-based server system makes it possible to reach vessels in different geographical locations. Moreover every vessel operates as a weather station. As a consequence of this, the number of weather stations increased through the additional AIS-capable vessels. The interaction between the on-board unit and the land-based server provides a more fine-grained coverage of depth data for non-commercial vessels. The depth data can be accessed though a web service. Hence our infrastructure provides an improvement of security and navigation on seas.

As an example of how real world problems are going to be solved in IT-projects, our newly designed communicationinfrastructure shows that the process of defining requirements has to be done in the first phase of the project. The resulting functional specification document is the fundament for designing the technical components of the new system. In addition, the entire project should be managed with agile project management methods, because of its flexibility and adaptability.
Implementing and testing the on-board unit and the land-based server system is the current task of our research team.

5. References

[1] Oceanweather Inc.: http://www.oceanweather.com, last visited on Apr 17, (2013)

[2] National Oceanic and Atmospheric Administration (NOAA) - The National Weather Service: http://www.weather.gov, last visited on Apr 12, (2013)

[3] SVB GmbH - Spezialversand für Yacht- und Bootszubehör: http://www.svb.de, last visited on Apr 17, (2013)

[4] SVB GmbH - Portmaps.com: http://portmaps.de, last visited on Apr 17, (2013)

[5] Changchuan, L.; Fang, D.; Jie, L.; Gaoyao, W.: AIS System and the Applications at the Harbor Traffic Management, IEEE 08, WiCOM '08: 4th International Conference on Communication, Networking and Broadcasting, Dallian, China, 2008

[6] International Maritime Organization- Imo.org: http://www.imo.org/blast/mainframe.asp?topic_id=754, last visited on Apr 17, (2013)

[7] Eriksen, T.; Nordmo Skauen, A.; Narheim, B; Helleren, Ø; Olsen, Ø; Olsen, R: Tracking Ship Traffic with Space-Based AIS: Experience Gained in First Months of Operations, IEEE 10, WSS 10: International Waterside Security Conference, Carrara, 2010

[8] Skolnik, M.: An Introduction to Radar: http://www.turma-aguia.com/davi/skolnik/Skolnik_chapter_1.pdf, last visited on Apr 17, (2013)

[9] National Marine Electronics Association: http://www.nmea.org, last visited on Apr 17, (2013)

[10] Highsmith, J.; Cockburn, A.: Agile software development: the business of innovation, *Computer*, vol.34, no.9, pp.120,127, Sep 2001

[11] Rising, Linda; Janoff, N.S.: The Scrum software development process for small teams, *IEEE Software*, vol.17, no.4, pp.26,32, Jul/Aug 2000

System Level Design of a Viterbi Decoder with Mentor Graphics Vista™

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Keywords: System Engineering, Tool Chain, Hardware and Software Codesign, Design Flow, Collaborative Work, SystemC, Transaction-level modeling

Abstract: On the one hand the "time to market" becomes more important for the development of hardware and software. On the other hand the complexity of the systems increases rapidly. Mentor Graphics Vista™ trying to speed up and simplify the development process of complex systems and offers an early assessment of performance and power consumption [4].

As a student project we implemented a Viterbi decoder with Vista™ to test the benefits of the software. The entire hardware for the decoder was written in SystemC Transaction-level modeling (TLM) method to validate its functionality.

1. A brief introduction to Hardware / Software Codesign

Complex digital systems are getting bigger and bigger nowadays. A generic digital application can consist of thousands of single components, connected by on-chip-busses or wires.

The inherent complexity provides plenty of room for misspecifications and errors of all kind. With continuous growth of digital applications, science began to search for new methods and processes, to simulate and design those.

The defacto default for most of the time was a totally separated design of the different aspects of a digital application. This separation of the development of hard- and software lead to a great gap between both sides. The early partition of the system allowed no further replanning without a hard impact on both deadlines and costs of the product. Also, the integration-testing started at a very late point in the development process (cf. waterfall model).

At this time, it could be critical for the completion of the project, if some interfacespecifications on hard- or software-side (or both sides) where misinterpreted or turn out to be simply wrong.

To interfere with these approaches, the discipline of Hardware / Software Codesign (HW/SW-Codesign) as we know it today was born.

The essence of this discipline is a new approach of designing the different components of the system. Instead of thinking about partition or specific details of the implementation, the whole application is implemented prototype-wise in software first, often under use of a specific DSL (Domain Specific Language) like SystemC.

The implementation is strictly focused on modules that are connected through busses.

This modular approach ensures, that the partitioning can be started in a very late state of the development. cf. [1],[2] and [3]

2. Viterbi

As an example project to work with Mentor Graphics Vista™, a Viterbi decoder [6] has been developed. The Viterbi algorithm is a widely used method in communication engineering for data transfers witch need an error correction. Especially during data transmission through the air like cellular radio or Wi-Fi, there are often disturbances that change the data. The Viterbi decoder consists of multiple parts which can implements both sides, in Hardware or Software. This is the reason, why this is a good example for showing the Hardware/Software Codesign concept in Mentor Graphics Vista™

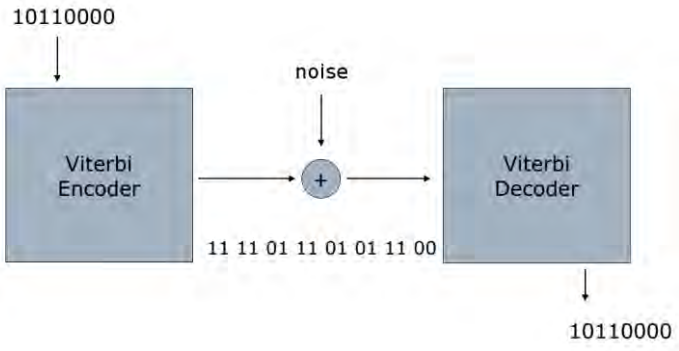

Figure 1: Viterbi overview

The entire system can be seen in Figure 1. It contains a Viterbi encoder, which encodes the transmitting data with a convolutional code. The coded data contains more bit than the original.

After encoding, the encoded data will be sent with the corresponding method (e.g. radio) to the receiver. This transfer is often susceptible, so the receiver may receive wrong data.

The receiver has to identify and correct errors, caused by noise, to decode the received data back to the original. These tasks are handled by the Viterbi decoder, developed in this project. The process of decoding is much more complex than that of the encoder.

The Viterbi decoder analyzes the received data and decides whether the data can be right in this constellation. When differences are found, the probabilities of possible correct data are determined, and the output with the highest probability will be returned.

3. Digital System Design with Mentor Graphics Vista™

The software product Vista™ by Mentor Graphics provides several features in transaction level modeling (TLM) like system-level design. Vista™ is based on an electronic system level platform to design the architecture, analyze the verifications and provides virtual prototyping. Therefore it delivers technologies in TLM modeling, design assembly, debugging, design verification and performance analysis of the software functions and hardware design. [10]

In order to develop a new digital system, Vista™ provides four different perspectives for the development. From the perspective as a system engineer the functions to collect and inspect requirements and identify the architecture are available. To implement the requirements in a component based way, the tool assists to secure the timings, resource requirements and concurrency. Vista™ supports for testing the validation and verification of design, based on the requirements. It is possible to test the connectivity and communication between multiple domains. Vista™ also helps to integrate the validated components to a final system. In detail you can test the functions, timings, connectivity and packaging of the whole system. [9]

For hierarchical designs Vista™ includes a graphical block diagram for SystemC and TLM2.0. Vista™ allows to connect compiled models to each other. After saving a block diagram Vista™ generates the SystemC code automatically. A unique capability allows users to maintain graphical and textual views synchronized and updated constantly. [10]

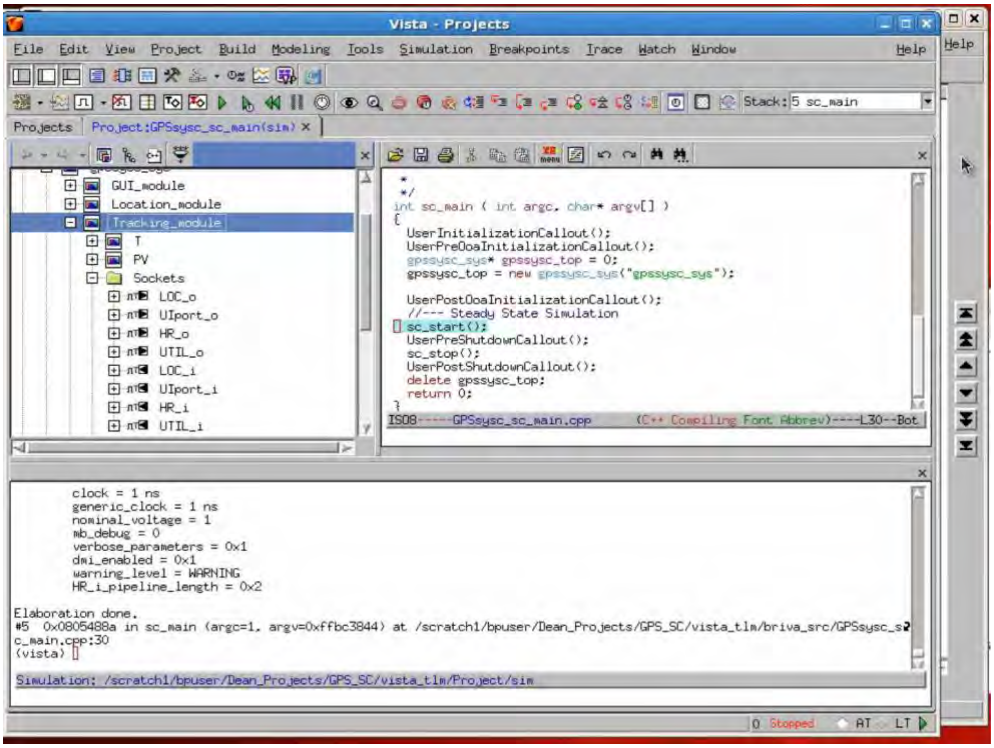

Figure 2: Vista™ – SystemC coding

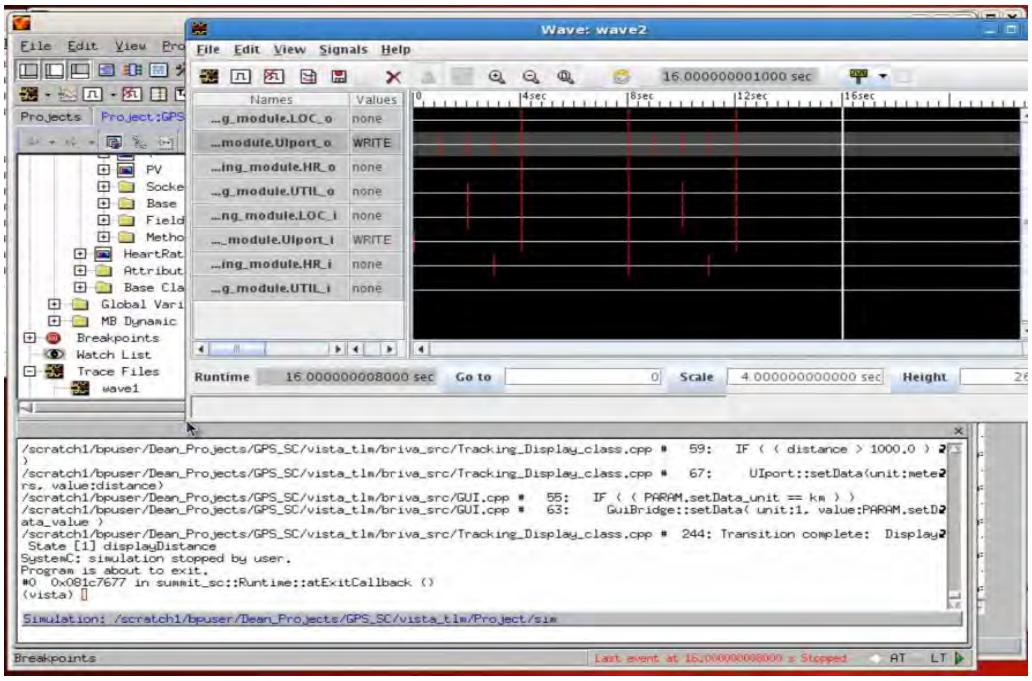

Figure 3: Vista™ – Waveform diagram

For the development of the Viterbi Decoder in SystemC exists several alternatives. First of all the software Matlab from MathWorks in combination with Simulink, HDL Verifier, Embedded Coder and SystemC compiler. [7] Secondly the eclipse plugin Damos. This plugin provides similar functionalities as Matlab Simulink. It is possible to use graphical and textual editors to create a digital system. [8] The last option is to install the latest version of SystemC for compiling and GTKWave for your visual output. [11]

4. Designing the Viterbi Decoder

The system engineering process begins with the drafting of a vision and scope document. This document describes the comprehensive conception of the project depending on the business targets. It contains the expectations of the customer, explicit project goals, constraints and features. The subsequent tasks are the requirement analysis and the system design, which are described in the following.

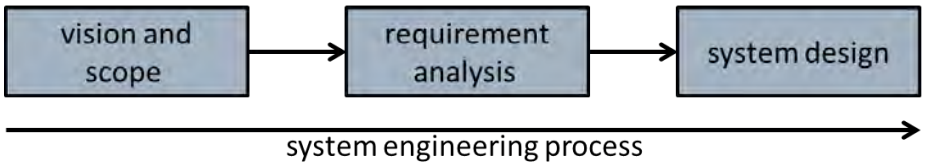

Figure 4: system engineering process

4.1 Requirement analysis

The first step of the requirement analysis is the decomposition and the structuring of use cases. The use cases describe the behavior of the Viterbi decoder. *Table 1* shows a few exemplary use cases. Based on the use cases the associated requirements are defined. Every requirement is given a priority which is shown in *Table 2.* In consideration of the requirements the test cases are determined. These are needed for validation and verification and can be seen in *Table 3.* At last the columns for the associations are completed. The associations for the requirement with identifier 1 are exemplary highlighted.

During the process several disadvantages of using tables instead of a requirement analysis tool became obvious. Functions like dynamic associations, traceability and a multi-user interface were needed.

Id	Use Case	Description	Associated requirements	Associated test
1	Data input with one bit error	Receiving data bits with one error	1	1
2	Data input with clock frequency of 5 MHz	Receiving data from an encoder with a clock frequency of 5 MHz	2	2, 3
3	Data input as bytes	Receiving data from an encoder as bytes	3	4, 5

Table 1 Use Cases

Id	Requirement	Description	Associated use case	Associated test	Priority
1	Correction of one bit error	Correcting data bits with one error by the decoder	1	1	must
2	Compatibility with different clock frequencies	Receiving and decoding data with a clock frequency of 5 and 10 MHz	2	2, 3	must
3	Configuring number of input bits	Changing number of input data between one byte and 16 bit	3	4, 5	can

Table 2 Requirements

Id	Test Case	Description	Associated use case	Associated requirement
1	Data input with one bit error	Testing if one bit error is corrected by the decoder	1	1
2	Data input with a clock frequency of 5 MHz	Testing if data input is correctly decoded by using an encoder with a clock frequency of 5 MHz	2	2
3	Data input with a clock frequency of 10 MHz	Testing if data input is correctly decoded by using an encoder with a clock frequency of 10 MHz	2	2
4	Data input as bytes	Testing if data input is correctly decoded by using an encoder which is sending bytes	3	3
5	Data input as 16 bits	Testing if data input is correctly decoded by using an encoder which is sending 16 bits	3	3

Table 3 Test Cases

4.2 System Design

Before a decision about the target platform is made an implementation-independent description of the system has to be set up. The description contains a functional, structural and a time-dependent analysis of the Viterbi decoder. *Figure 5* represents the functional view of the decoder. It shows the main functions hierarchically.

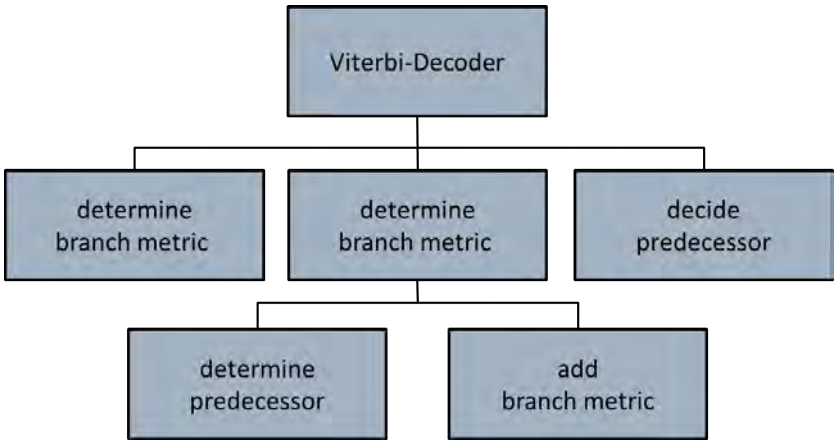

Figure 5 Functional View

In *Figure 6* the structural view is shown. The single elements base on an implementation components of the decoder. According to this view a time-dependent view was created. By the use of these views a complex system can be designed through steps of refinement [5].

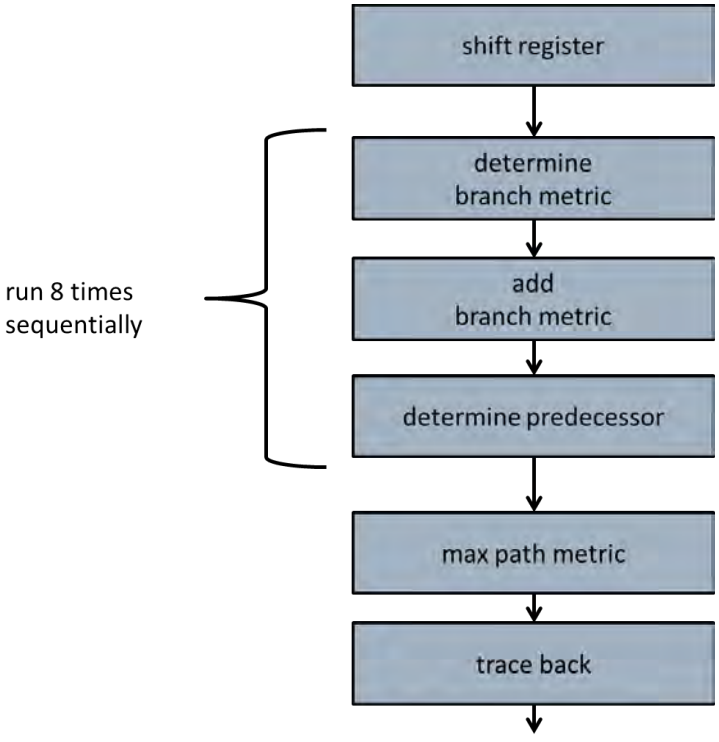

Figure 6 Structural View

A supplementary way to specify the system is by using graphs. A data flow, control flow and sequence graph were drawn. The nodes represent the activities and the edges the dependencies. The data flow graph shows the data dependencies between operations. The control flow graph represents the logic of the decoder depending on the code. The sequence graph combines the two aforementioned graphs. [5]

4.3 Morphological analysis

After the implementation-independent specification of the system is completed a platform can be chosen. A morphological analysis was performed to compare different platforms after several criteria which can be seen in *Table 4.* This helps to go through all possible software and hardware solutions. [12]

platform / criteria	processing speed	costs	power consumption	development effort	availability	initial training	size	dataflow paradigm	bit manipulation
GPP	-	-	-	++	++	++	–	o	o
GPU	o	+	–	o	o	o	-	+	o
DSP	o	+	o	+	+	+	o	++	+
MCU	-	++	+	++	++	+	o	-	o
ASSP	++	++	+	o	--	-	++	++	++
FPGA	+	-	o	o	+	o	o	++	++
ASIC	++	-- / ++	++	--	-	–	++	++	++

software implementation
hardware implementation

Table 4 Morphological analysis

5. Results and Conclusion

This Paper describes the procedure of the Hardware and Software Codesign with the use of the Mentor Graphics Vista™ Tool chain using the example of the Viterbi-Decoder.

Due to the ever increasing technology advancement and the consequently increasing complexity and variety of applications, it is necessary to use optimal design processes. The HW / SW-Codesign allow joint design of hardware and software, which generates different design alternatives that need to be analyzed and compared. It also allows a coordinated and systematic design flow, in which a lot of automated processes and computerized tools are used. In the classical methods, the hardware is usually built first and the software will be developed afterwards. But with HW / SW-Codesign a concurrent engineering of hardware and software components is possible.

Based on the Viterbi decoder we were able to go through the design flow of HW / SW-Codesign at one specific system step by step. During the requirements analysis, the specifications were chosen based on the Viterbi paper [6]. In the system design stage the Viterbi de- and encoder was described formally with the help of data flow, control flow and sequence graphs. In the next step the formal description was implemented by using SystemC. This already allowed the first tests of the Viterbi algorithm. Transaction-level platform prototypes were then modeled in Mentor Vista™. Finally a pure fictional decision about the suitable target platform was done with the morphological analysis.

Even though the complexity of this sample project does not meet the complexity for which the HW / SW-Codesign is intended we could still benefit from the advantages of the design process. Especially without the implementation in SystemC and TLM Platform prototypes with Mentor Vista™, it would not have been possible to perform realistic test. Also an understanding could be obtained of the capabilities that HW / SW-Codesign can reduce the cost and time-to-market of a project [5].

6. References

[1] A Framework for Hardware-Software Co-Design of Embedded Systems : http://embedded.eecs.berkeley.edu/Respep/Research/hsc , last visited on June 23 rd ,(2013)

[2] Giovanni de Micheli & Rajesh K. Gupta- Hardware/Software Co-Design: http://210.212.205.26/sudarshan/Main/Courses/2012-2013/OddSem/Hsc_12/lecses/refs/lec01/demicheli97hardwaresoftware.pdf, last visited on June 23 rd ,(2013)

[3] Jürgen Teich - Hardware/Software Codesign: The Past, the Present, and Predicting the Future http://ieeexplore.ieee.org/stamp/stamp.jsp?reload=true&arnumber=06172642 , last visited on June 23 rd,(2013)

[4] Mentor Graphics - Vista™ Architect : http://s3.mentor.com/public_documents/datasheet/esl/Vista/Vista-architect-ds.pdf , last visited on June 23 rd ,(2013)

[5] M. Platzner: Skriptum zur Vorlesung - Hardware/Software Codesign (2007)

[6] C. Langton: Coding and decoding with Convolutional Codes (1999)

[7] MathWorks – Untimed SystemC/TLM Simulation: http://www.mathworks.de/products/hdl-verifier/examples.html?file=/products/demos/shipping/edalink/TimingModes_uttb.html , last visited on June 22nd, (2013)

[8] Eclipse – Damos: http://www.eclipse.org/proposals/tools.damos/ , last visited on June 22nd, (2013)

[9] Mentor Graphics – System Modeling: SystemC Virtual Platform Creation: http://www.mentor.com/products/sm/multimedia/player/systemc-virtual-platform-creation-3f71a6c2-b5a4-4dac-bad3-5162234c868c , last visited on June 22nd, (2013)

[10] Mentor Graphics – Getting Started With Vista™: http://www.iuma.ulpgc.es/~nunez/clases-micros-para-com/Embedded-ARM-ST-o-Platforms-MPSoC/Vista™_gs.pdf , last visited on June 22nd, (2013)

[11] GTKWave – Welcome to GTKWave: http://gtkwave.sourceforge.net/ , last visited on June 22nd, (2013)

[12] General Morphological Analysis: http://www.swemorph.com/ma.html, last visited on Jun 21, (2013)

Shaping the Information Supply Chain for M2M Systems

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Abstract: Machine2machine communication is one of the major technology trends for the future internet and for information technology in general. It deals with the communication between machines via internet technology. Such intelligent technical systems are able to coordinate their work or to ask for maintenance automatically. The inherent computing power and communication capability of M2M systems opens new dimensions for the application of technology. Usually, the computing power is integrated into a technical system by adding a specific M2M device, e.g. a small computing and communication node. In future, the deep integration with the technical system is intended. This leads towards cyber physical systems (CPS). CPS connect the material physical world with the cyber space. CPS are expected to be an enabling technology for trends like smart grids, ambient assisted living (AAL), e-mobility and future production systems (the fourth phase of the industrial revolution – industry 4.0). M2M systems are not just monolithic and independent technical systems. They are deeply embedded into the application. The integration with other IT systems (e.g. ERP and PLM systems) and business processes form a so called digital ecosystem. This business information ecosystem is driven by an application specific information supply chain. Designing, maintaining and managing these complex information supply chains is a major trend for IT project management and IT systems engineering. This contribution structures the characteristics of such information supply chains and names the challenges that need to be addressed by IT project management. It is intended to set a starting point for the development of the respective processes, methodologies and tools by formulating research questions for further research in the project management domain.

1. Introduction

The evolution of information technology is one of the main trends of the past decades. It started from a few computers used by several expert users (mainframes), evolved over the personal computer (one fixed computing terminal used by one user) towards today's mobile devices (laptop computers, smart phones, tablets). Due to the ever falling cost of computing power, the trend is expected to continue towards ubiquitious or pervasive computing where computing power is installed everywhere and only recognized by people indirectly. This trend is accompanied by the evolution of the internet which is the main technology for communication between computing devices and therefore between computer users. Since the introduction of IPv6 (the most recent version of the internet protocol) the internet is technically able to connect very high numbers of computing devices (~3.4×10^{34}).

Small communicating computing devices are the basis of some major technical innovation areas such as smart grids (intelligent energy networks), e-mobility (e.g. vehicle2grid communication, car2car communication), ambient assistant living (AAL, enabling homes to support their inhabitants by adding sensors and smart devices) and intelligent logistics and supply chains (e.g.

by using RFID – Radio Frequency Identification). These developments integrate computing power (and maybe some kind of intelligence) and communication capabilities into technical systems – into things. Therefore, the extension of the internet towards connecting things led to the term "Internet of Things – IoT" [3,5,6,8,17]. First, around 2000 the idea was limited to tagging things with an RFID-tag and making them traceable, e.g. in logistics, but soon (around 2005) the idea was extended towards intelligent technical systems and towards being the major driving force for the development of the future internet [3].

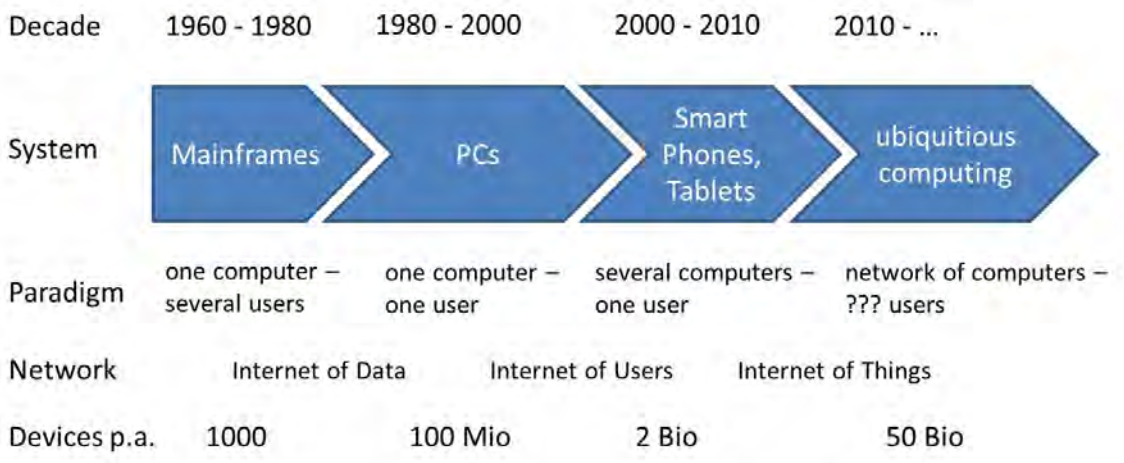

Fig. 1: History and Development of the Computing Domain

The deep integration of computing and communication devices and of advanced IT into technical systems leads towards Cyber Physical Systems (CPS) [1]. Computer science concepts like self-organization and self-optimization can be integrated into technical systems creating so-called intelligent technical systems. The combination with services in the virtual domain (e.g. cloud computing) forming a vertical integration and the provision of interaction technologies for the (human) users open the door towards new and innovative products and systems. A specific part of the Cyber Physical Systems is the communication and collaboration between the computing devices and hence between the "things". This part is called the Machine2Machine (M2M) communication and describes mainly standards, platforms, protocols and methodologies to support this communication [7,13]. Due to the expectation of a very high number (billions, trillions) of communicating devices the market size and the impact for the industry is tremendous. Developing, building, maintaining and operating such M2M systems is therefore one of the major trends for IT project management in future. Especially in Germany, the emergence of Cyber Physical Production System (CPPS) is positioned as the driver for the fourth phase of the industrial revolution (Industry 4.0 [2]) leading towards the production of highly individual products in contrast to today's mass production.

The deep integration of computing and communication devices in Cyber Physical System (or the Internet of Things) creates important aspects apart from technical considerations. CPS have an impact on economic or socio-economic processes and systems. They are tightly connected to both the "real world" and the "cyber space". A CPS cannot be designed or applied without considering the environment it is placed into. Understanding the holistic view of the application of IT systems, the term "Digital Ecosystem" emerged [5,10,12]. Especially the economic aspect with the consideration of the respective players and business models is addressed by the view of "Digital Business Ecosystems". Apple's approach for running the iPod, iPhone and iPad business is a prominent example for this approach [10]. From IT management point of view, such digital business ecosystems are based on information supply chains. The term

"Information Supply Chain" [11,16] describes, how information is produced, processed and used by a certain business process, a company, an organization or within a digital business ecosystem. Therefore, the information supply chain is what IT project management has to plan, manage and control in an M2M- or IoT-Project.

2. M2M ecosystems

M2M ecosystems are based on common building blocks, are using certain platforms and interfaces and communicate via certain protocols. Nevertheless, an M2M ecosystem is designed for a specific application (e.g. energy micro grids). Tailoring is therefore necessary to combine the right components and to adapt them to the specific needs.

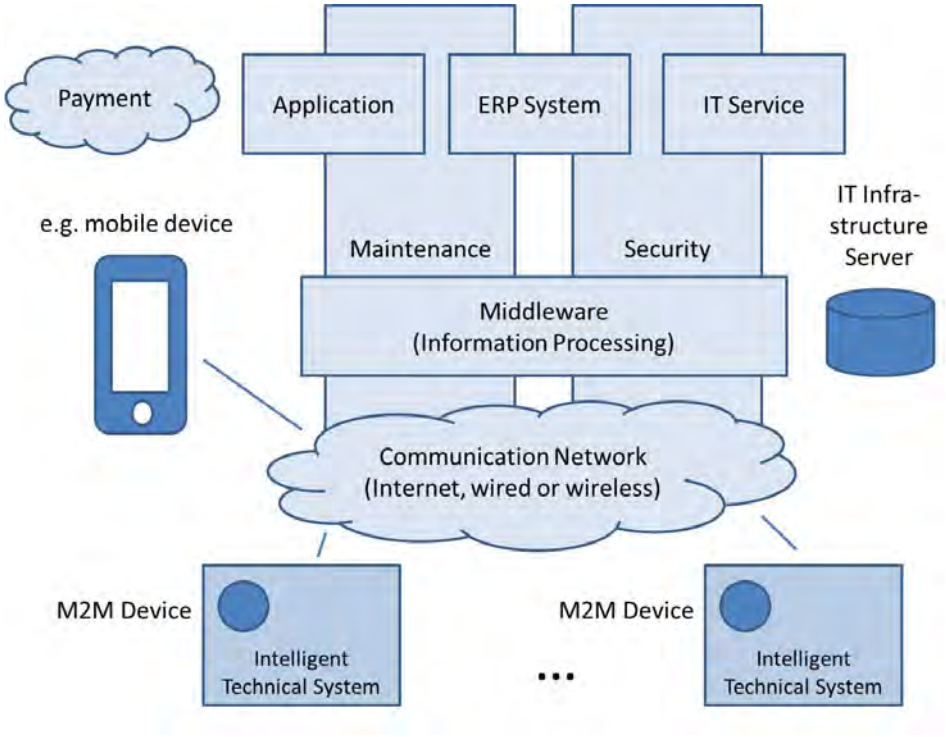

Fig. 2: IT System View of an IoT/M2M System

The typical taxonomy of an M2M system defines certain components:

- The M2M device is a computing device attached to a technical "thing", e.g. a machine or a sensor. It can collect data, but it can also influence or control the technical system via actuators.
- The M2M gateway is a communication device which connects the M2M device to the communication network. This is usually an internet based network. It can be a wireline or a wireless network (e.g. the UMTS network). Sometimes, the M2M gateway is considered to be part of the M2M device, e.g. there are semiconductor chips integrating both functions.
- The M2M network connects the devices, usually via the Internet Protocol, forming the Internet of Things (IoT). It is part of the M2M network domain.
- The M2M application layer offers IT services for data processing, e.g. deciding to call the maintenance service, if a M2M devices fails. This layer is considered to be a partly

integrated into the M2M middleware. An IT middleware is a collection of services that is forming the interface between the user (or the user application) and the technical system. Since it is processing the data (not only translating) it can be more or less complex.

- Mobile devices or other internet based devices can be considered to be part of the M2M system. They are used as interfaces to the M2M system and therefore they are part of the overall ecosystem.
- The M2M application layer is an abstraction of the IT systems dealing with the processing and control of the M2M data. Using the ecosystem view, the application layer is much more complex. Applications are basically all systems using the underlying M2M system. This can be the integration into ERP systems (e.g. for managing supply chains), into PLM systems (e.g. controlling production systems) or the connection to business intelligence and data mining tools. In this case, the M2M system is just the connection of the IT systems from the virtual domain (cyber space) with the "things" in the real world. The intelligent combination of IT systems like ERP or business intelligence with M2M systems is the core of the digital business ecosystem.
- Another part of the digital business ecosystem is the operation and maintenance of the underlying IT infrastructure (e.g. server systems, backup systems, firewalls, communication networks).
- Payment services are required to create a business model for the digital business ecosystem.
- Security is a very important part. Since the Internet of Things is connected with the world wide internet, all security issues from this domain are entering the world of things. A solid security concept is part of all digital business ecosystems.
- The development of valid business models is part of a digital business ecosystem, too. To create economic value is a major challenge in today's internet businesses. For M2M ecosystems, this question is not really solved yet. The creation of a business model for a specific application case requires as much tailoring and adaptations as for the technical system.
- Last but not least, technical systems like M2M systems have to be used by human beings. At some point, the question comes up where the human being fits in. In many cases, this is not just the user but a number of stakeholders (e.g. in renewable energy systems). Participation of users and stakeholders already during the development but definitively during the operation of a digital business ecosystem is crucial for the success.

Connecting the components and stakeholders, defining the (business processes) amongst them and deriving the information flows between them (the respective information supply chain) is a systems engineering task. It requires a M2M systems engineering methodology and respective processes and tools.

Therefore, one type of IT projects in the context of M2M ecosystems is the design (or engineering) of such M2M systems. It seems to be straightforward to take the learning from software development projects (e.g. software engineering methodology) into account and to run such IT projects in a similar way. Furthermore, a lot of experience from systems engineering projects exist [18,19].

The second type of related IT projects in the context of M2M ecosystems is about the adaptation, installation, roll-out and operation of such a system. It is more similar to "classical" IT projects with aspects of business process reengineering [20]. With this kind of projects, people from business administration and business computing feel much more comfortable. The huge body of knowledge on IT project management deals mainly with such projects.

One of the most prominent use cases for a digital business ecosystem based on M2M communication are energy micro grids. Such micro grids (or smart grids) are expected to be the technical back bone of de-central renewable energy systems. Using a de-central micro grid has several advantages over traditional national grids. It is expected to form a more stable overall energy system since complexity is reduced and a failing micro grid does not necessarily harm other micro grids. The value chain remains local instead of draining money out of the region. The involvement of many players both as consumer and producers (a so-called prosumer [21]) is an instrument for stakeholder participation and for changing the socio-economic environment. Renewable energy is generated in smaller facilities and require de-central approaches.

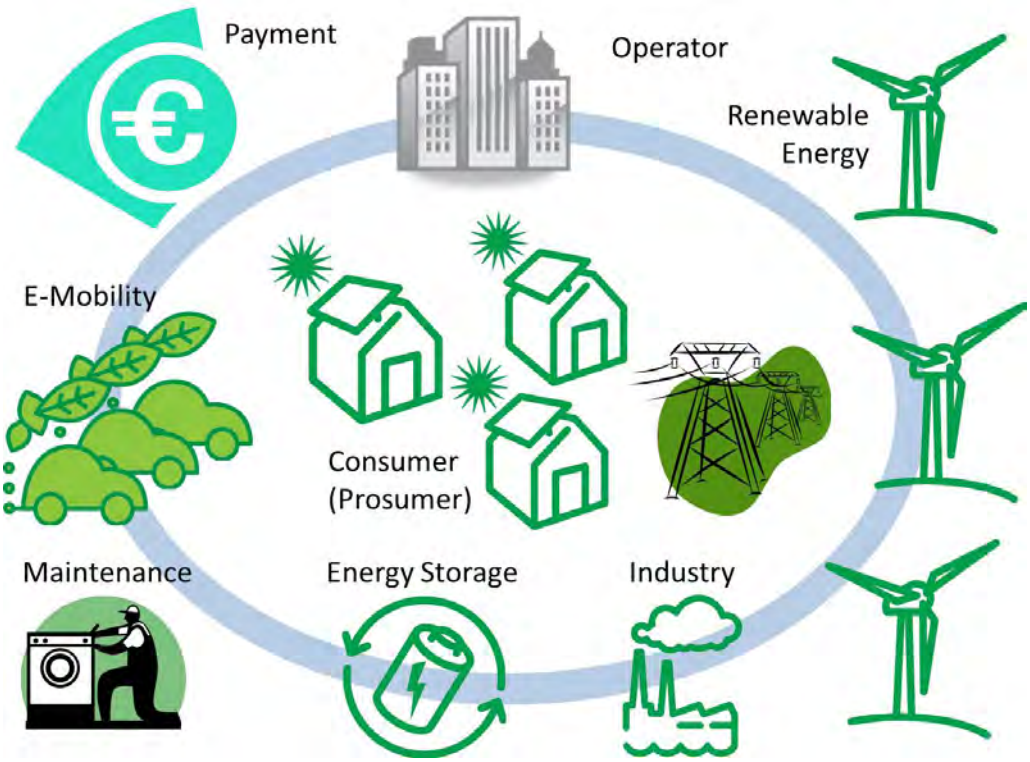

Fig 3: Example of an IoT/M2M Ecosystem: Micro Grid Setup for De-central Energy Systems

For a digital business ecosystem a micro grid forms a typical application case. The production and consumption of the energy has to be balanced permanently. This requires constant communication between producers and consumers and control of a big number of de-central technical systems. Mobile systems like e-cars can be used to store energy or to consume energy. Users in households want to optimize their energy usage. Maintenance needs to be organized, ideally as predictive maintenance (fixing a part before it fails). All these tasks can be managed by using IT services and a M2M system. To create a business case, both the energy and the services need to be charged to the user. Payment services are an IT service, too.

Apart from technical control, more sophisticated services can emerge, e.g. several operators of wind mills combine their purchase power to get better prices for maintenance services. The maintenance service provider on the other hand can optimize the service tour of his staff by using M2M data. In such a digital ecosystem, the computing power and communication capability helps to create an added value.

3. Information Supply Chain

From information processing point of view, the flow of information through the layers of the M2M systems forms an information supply chain [11,16]. Similar to a logistics supply chain, the information supply chain has to make information available to the right users at the right time and at the right place. Managing information supply chains (ISCs) is pretty similar to supply chain management (SCM) for logistics. Therefore, many concepts (e.g. process modeling) are state of the art. Nevertheless, an information supply chain (ISC) is an IT system and it is intended to work fully automized with very limited human interaction (only maintenance and end user layer). The challenge is to integrate various IT systems, services and applications (probably from various IT suppliers). Interfaces and interaction amongst the components have to be defined. The hardware platforms need to be able to support the IT systems. The overall system has to be reliable and offer the required performance. Further big IT topics like IT security, payment services, IT maintenance and control need to be addressed when designing the information supply chain (ISC) for a specific use case.

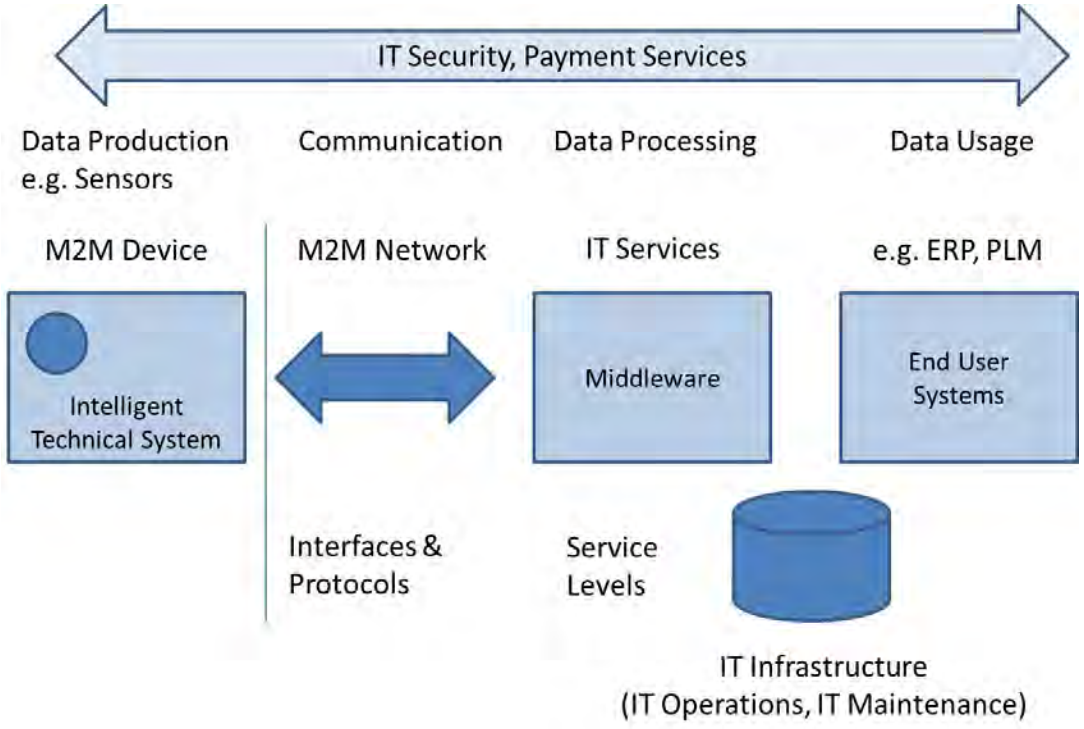

Fig. 4: Information Supply Chain of an IoT/M2M System

Information supply chains deal with the capture and delivery of information (data). For M2M systems, information is captured by sensors. In addition, it can be delivered to actuators. Both are part of the M2M device, meaning the starting point and the end point of the information supply chain can be the same for some information.

Communication within an M2M information supply chain is an important topic, too. M2M systems are usually distributed over various locations (e.g. factory facilities, a renewable energy region, a house). Communication has to use complex networks, e.g. a mobile phone operator network. In case of an Internet-of-Things (IoT) System, the internet protocol is used with all the underlying complexity and issues (e.g. security) of the internet.

Information processing in M2M systems is done by using middleware systems. Middleware is controlling both the maintenance (e.g. adding or removing M2M devices) and operation (gathering data, reacting to data) of the system. For middleware software, standard platforms and protocols are used. There are ongoing research and development activities targeting a standardized set of platforms and protocols for the Internet-of-Things (IoT) in general and M2M in particular [8]. Nevertheless, for an application specific M2M system, the platforms and protocols have to be tailored to the use case and adapted. Tailoring is important in both M2M systems engineering projects and M2M IT projects.

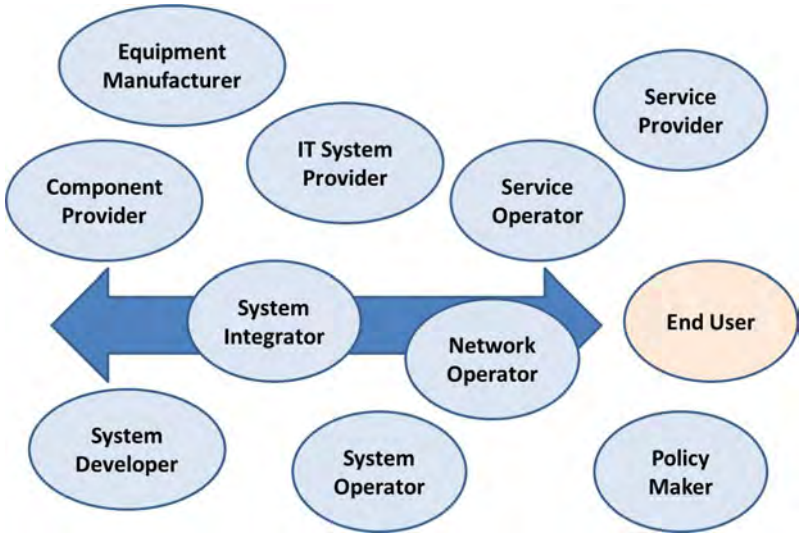

Fig. 5: Players/Value Chain of an IoT/M2M System

Based on the M2M middleware, the end user applications are operated. In many cases, these applications are enterprise resource planning (ERP) tools or business intelligence applications. They are applications from the domain of classical business IT. Both the middleware and the end user applications are operated on PC or server systems. Apart from interfacing with M2M devices, they serve PC applications, web applications and applications on mobile devices (e.g. smart phones, tablets).

Designing an operating an M2M information supply chain (ISC) is driven by the typical two main criteria of IT management:

- The information supply chain has to be designed, tailored and adapted in a way that supports the end user intended benefit. It has to achieve the defined results. Meaning, it has to be **effective**.

- The information supply chain has to achieve the intended benefit by using as few resources (e.g. time, money, energy) as possible. Meaning, it has to do the job **efficiently**.

Furthermore, the operation has to fulfill the expectations towards effectivity and efficiency designed into the information supply chain. Both targets have to be considered when shaping the M2M information supply chain to its needs.

Apart from finding a proper technical solution for the information supply chain, this has to involve an analysis and optimization of the respective value chain. Along the information

supply chain, various players (see Fig. 5) are doing business, creating added value for the end customer and charge money. Since M2M information supply chains are not a standard product but a tailored and adapted application specific product (or at least an application specific standard product – ASSP) there is no player providing complete off-the-shelf systems. Usually, there are companies covering only one (or at least only a few) roles in the value chain. Nevertheless, the business cases have to work for each player. Designing an optimized business process along the value chain is still a major topic for M2M systems.

4. Major Challenges and Problem Characteristics

The definition of a IT project management methodology for M2M projects needs to be based on the main characteristics of the respective project domain.

First, it has to consider two pretty different types of projects:

a) M2M systems engineering projects which develop the technical system according to the needs of the use case. This is comparable to software engineering projects.
b) IT projects which tailor, adapt, roll-out and operate M2M systems. This is comparable to classical IT project management.

Second, three major streams of a M2M project need to be managed in parallel and – even more important – have to be synchronized and connected:

a) The technical project which is designing, tailoring and operating the respective information supply chain.
b) The business project which is creating and running the value chain for the use case.
c) A change project which is considering impact on the socio-economic environment and dealing with the internal and external stakeholders.

Understanding this classification into different views on the same project (usually, a M2M project will contain all aspects) the main characteristics differentiating M2M projects from other IT projects can be described:

- M2M/IoT systems and the respective digital business ecosystems are inherently **de-central**. Due to the complexity (number of devices, number of players, diversity of devices/players, inherent dynamics) a central or hierarchical approach to handle them is likely to fail. The systems and accordingly the projects have to be based on a process oriented organization paradigm or (better) on a networked (peer-to-peer) approach. Hierarchy based organizations are likely to create digital business ecosystems lacking the flexibility to re-act to changes.

- Setting up the required information supply chains and value chains results in a **vertical integration** of components, services, business models and players. This leads to a **cross-domain** collaboration. The issue of a common language versus domain specific languages arises for both the technical and human players. This area has to be understood and to be addressed by project management. Otherwise, the complexity is not manageable.

- The high number of stakeholders and the impact of digital business ecosystems on the socio-economic environment (in addition to the technical environment) carry specific challenges for project management. The change management character of the project needs to be addressed. This requires **stakeholder participation**. For the acceptance of

the M2M system it is crucial to think about stakeholder participation. Elderly people will have issue to accept a smart home deciding about their daily life. A renewable energy micro grid will not be accepted by people if it only for the benefit of a multi-national energy provider. A solution for stakeholder participation in M2M/IoT systems can be the integration with the social web approaches. An example can be the setup of a "thingbook" where profiles of things can interact with both the human user and the machine. People can influence the M2M/IoT system e.g. by forming groups or by connecting things according to their "likes".

- **Tailoring** of standardized solutions and protocols to the application specific needs is a promising approach for M2M/IoT systems. Tailoring means both: cutting out unnecessary parts to reduce complexity and adapt per-defined parts to fit to the use case. But apart from tailoring the technical solution (the information supply chain) tailoring needs to be considered for the value chain and for the project management methodology, too. To run all M2M/IoT projects with one project management methodology will make them heavy. To allow the flexibility and speed required in this IT domain, lean project management is mandatory. Meaning, processes and methods need to be tailored to the individual project.

- The value chain for M2M/IoT systems contains various challenges. One major issue is that the main **business model** for internet business does not really work for M2M. Most internet businesses are to some extend based on advertising. Machines don't re-act to advertising. Therefore, it may be difficult to design a digital business ecosystem in the M2M area based on the well know internet business models. Since end-user customers are trained to not paying for IT services in the internet, new ways for creating a value chain need to be defined.

- One main risk and obstacle for digital business ecosystems connected to the internet are **security** issues. Especially for M2M this is not yet solved. Machines were designed with respect to safety in the past. Security was never an issue since the machine was installed in closed workshops and was only open to expert users. Access and control via the internet are new. The stuxnet attack showed which threads are involved with attaching the things to the internet.

These bullet points are not intended to be complete but to serve as a starting point for thing about how an IT project management approach for M2M/IoT systems may look like.

5. Research Questions and Conclusion

The considerations explained in this contribution lead to research questions for future research on project management methodology and information supply chain management for M2M/IoT systems. This contributes to the main research question: How to set up and how to manage a digital business ecosystem in the era of the Internet of Things? Project management research can contribute to solutions for this question by answering specific research questions in this context:

1) What type of IT projects do we deal with in the era of the Internet of Things? What is a proper taxonomy? What is different/similar to known IT projects?

2) What can IT project management re-use from known information supply chain management methodology? Does the information supply chain approach fit for M2M/IoT systems?

3) What does the abstraction as a digital business ecosystem mean for IT projects in the M2M/IoT domain? Does this help to integrate the technical view, the business view and the change management view on such projects?

4) What are the stakeholders in such projects? How do they contribute to the value chain? What are their motivations and interests in such projects? Are there valid business models for the major players within the value chain?

5) Can systems engineering methodology or software engineering methodology be used to design and develop tailored M2M/IoT systems? How much domain specific knowledge is required to run such IT projects?

6) How can effectivity and efficiency be controlled and optimized in M2M/IoT systems? What are valid key performance indicators (KPIs)? What are the dependencies amongst them? How can the M2M information supply chain be tailored and shaped based on these KPIs?

The list of questions is not complete nor validated. Each question can be a research topic on its own but the questions are/may be dependent on each other. The conclusion from this contribution may be to start to find out about this.

6. References

[1] Acatech: AgendaCPS: Integrierte Forschungsagenda Cyber Physical Systems, German Acatech, 2012

[2] Arbeitskreises Industrie 4.0: Umsetzungsempfehlungen für das Projekt Industrie 4.0, Abschlussbericht des Arbeitskreises Industrie 4.0, 2012

[3] CERP-IoT: Vision and Challenges for realizing the Internet of Things, European Union, 2010

[4] J. Clarke, N. Suri, A. Sharma: Trust and security of the Internet of Things (IoT), BIC Discussion Paper, Coordinated by Waterford Institute of Technology, Cork Road, Waterford, Ireland, 2012

[5] Finnish Strategic Centre for Science, Technology, and Innovation: Internet of Things Strategic Research Agenda (IoT-SRA), Version 1.0, 2011

[6] S. Haller: The Things in the Internet of Things, Internet of Things Conference 2010, Tokyo, 2010

[7] Harbor Research: The emergence of smart business: Machine-To-Machine (M2M) & Smart Systems Forecast 2010 – 2014, Harbor Research Inc., 2010

[8] IoT-A: Internet-of-Things-Architecture, FP7 Project Home Page, Retrieved from http://www.iot-a.eu/public/front-page , last accessed June 06, 2013

[9] H. Kerzner: Advanced project management: best practices on implementation. 2nd Edition, John Wiley and Sons, 2004

[10] G. Kortuem, F. Kawsar F: Market-based user innovation in the Internet of Things. IEEE Conference “Internet of Things (IOT)”, Tokyo, 2010

[11] P. Lienhard: Information Supply Chain, Dissertation Universität Zürich, 2003

[12] F. Nashira, A. Nicolai, P. Dini, M.L. Louarn, L.R. Leon: Digital Business Ecosystem. European Commission, 2010, Retrieved from http://www.digital-ecosystems.org/book/de-book2007.html, , last accessed June 06, 2013

[13] OECD: "Machine-to-Machine Communications: Connecting Billions of Devices", OECD Digital Economy Papers, No. 192, OECD Publishing, 2012, Retrieved from http://dx.doi.org/10.1787/5k9gsh2gp043-en , last accessed June 06, 2013

[14] M. Presser, P. Daras, N. Baker, S. Karnouskos, A. Gluhak et al., "Real-World Internet – Position Paper", position paper of the Real-World Internet (RWI) Cluster of the Future Internet Assembly (FIA). http://rwi.future-internet.eu/index.php/Position_Paper , last accessed June 06, 2012

[15] S. Sarma, D.L. Brock, and K. Ashton, "The Networked Physical World, Proposals for Engineering the Next Generation of Computing, Commerce & Automatic-Identification", Auto-ID Center White Paper, October 2000

[16] S. Sun, J. Yen: Information Supply Chain: A Unified Framework for Information-Sharing, P. Kantor et al. (Eds.): ISI 2005, LNCS 3495, pp. 422 – 428, 2005

[17] O. Vermesan, P. Friess, P. Guillemin, S. Gusmeroli et al. (Eds.), "Internet of Things Strategic Research Roadmap", Cluster of European Research Projects on the Internet of Things, CERP-IoT, 2011

[18] INCOSE: Guide to the Systems Engineering Body of Knowledge - G2SEBoK. Retrieved from http://g2sebok.incose.org/app/mss/menu/index.cfm, last accessed June 06, 2013

[19] INOCSE: INCOSE Systems Engineering Handbook v. 3.2.2, INCOSE-TP-2003-002-03.2.2, 2011

[20] H.J. Johanson, P. McHugh, A.J. Pendlebury et. al.: Business process reengineering : breakpoint strategies for market dominance. Whiley, 1993

[21] A. Humphreys, K. Grayson: The Intersecting Roles of Consumer and Producer: A Critical Perspective on Co-Production, Co-Creation and Prosumption, Sociology Compass 2, 2008

Involvement of Students in Research Project Implementation: evidence from pilot action in Lithuania

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Keywords: eParticipation, argument visualization, engagement

Extended Abstract: The importance of ICT in supporting citizens' involvement in various policy development processes is becoming extremely important. ICT provides variety of tools and techniques enabling active involvement in of citizens.

Current paper explores involvement of students in pilot actions of EC supported WAVE initiative. Project WAVE aims to improve the inclusiveness and transparency of EU decision making at the national and European level by employing an Argument Visualization tool (namely Debategraph) in order to make the impact of complex EU environmental legislation on climate change more accessible and easy to understand for citizens, special interest groups and decision makers alike.

The WAVE platform and Debategraph tool were localized and piloted through two stages in three countries – France, Lithuania and United Kingdom. The piloting team tested various techniques engaging users and pilot results allowed identify key aspects of argument visualization tools deployment.

The most successful piloting pf WAVE platform was performed in Lithuania. Closed user group pilot was aiming to verify users understanding and acceptance of WAVE platform in order to improve it preparing for large scale pilot.

Open user group was aiming to deploy WAVE portal at large and attract at least 2000 user for the discussion. The open pilot (www.wave-diskusijos.lt)was jointly launched on the 22nd of April 2010 following the consortium decision to start open pilot phase on the International Earth Day.

The set of various users attracting and engagement tactics was used to achieve pilot targets such as face to face meetings with industry representatives, NGOs, activist and policy makers; press releases, feedback reports, reminding emails; AdWords campaign; Facebook campaigns on related topics pages; cooperation with local news portals.

Students were involved in various activities in both closed and open groups' pilot stages during pilot implementation in Lithuania.

The results of successful piloting in Lithuania describing pilot structure and student involvement actions will be discussed in this paper.

EXPERIENCES OF COMPETENCE DEVELOPMENT IN HIGHER EDUCATION

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Abstract: Due to the Bologna process, higher education institutions have to offer competence-based courses. Changing the curricula to meet this expectation has been done in Hungarian higher education institutions, however, the evaluation of the success of this process is missing yet. In our research, we intend to measure the process and the outcomes of trainings (experience-based courses) offered at an economic and business administration faculty of a Hungarian university. For this, we adopt a complex approach, defining competence development outcomes as the technical quality of the service, while students' evaluations of the delivery of these new types of courses as the functional quality of the service.

1. Introduction

As a result of the implementation of the Bologna process, a competence-based approach of education has appeared and modules of skill development has been introduced in higher education. Institutions thus has to face a difficult challenge of promoting and assessing the development of competences [1]. In addition, in a competitive higher education environment institutions, department and course managers consider service quality a highly important issue. In this sector, it may have long term effects for both the student and the institution, as it may influence student recommendations as well as their future monetary support [2]. Another reason for the interest in service quality is that university quality assurance systems emphasize student experience as one of the assessment criteria [3].
These processes have led us to devise a research planned for the long-run about the outcomes of putting competence and skill development into practice. An important methodological issue in this field is how to measure competence and skill development. In addition, the questions of how students accept the new methods of teaching (experience-based, small-group trainings) and of what their opinions are about this have arisen. Another question we intend to answer is how this new method fits in with the educational culture of the faculty in which it was implemented. Also, after a period of offering and conducting our training courses, we had to formulate a further question: what are those competences that can be developed at all in a fulltime education.

2. Technical and functional quality of trainings offered in higher education

The questions presented above have led us to think about higher education outcomes complexly, realising the difficulties of evaluating the quality of services evidently applies here. The quality of the service (in our case, university courses of training) has different meanings for different people; for service providers (in our case, the institution and the lecturers or instructors of the trainings themselves) and for customers (in our case, the students).
As providers and customers have different knowledge and often there is an information asymmetry between them, we may differentiate between technical and functional quality. Technical quality relates to what has been provided during the service process, while functional quality relates to how the service was provided [4]. In our consideration, this approach can certainly be applied in higher education. Technical quality refers to what competences are addressed during a training or other university course and the efficiency to achieve the development of these competences. Functional quality, on the other hand, refers to how these competences are developed: it is the environment, the

instructor, the method of teaching and student experiences: the process of the training which is important. We suppose that students' perceived quality of the service is affected by functional quality, while technical quality is related to the longer-term value of their knowledge and skills, often evaluated at the labour market, years after graduation.
In our research project, we intend to address both technical quality (competence development) and functional quality (students evaluations about the delivery of the courses).

2.1. Competences and their development

Spencer and Spencer's iceberg model plays a central role in defining the notion of competence – this is the approach we accept during our research. Competences may be divided into competency levels; therefore, competences may be motivation, traits, self-concept, skill or knowledge. According to the iceberg model, skills and knowledge are the more visible parts of personality, while self-concept, traits and motivation are a lot more hidden characteristics in the core of personality [5]. We may also define the function of a competence as is transforms knowledge into action creating a bridge between knowing and realising something [5].
The other model we used in our research is the self - efficacy model of Albert Bandura. According to his theory, each individual has a kind of outcome and efficacy expectation based on how that person estimates his/her own abilities to act. "An efficacy expectation is the conviction that one can successfully execute the behaviour required to produce the outcomes" [6, p.193]. The social-cognitive theory of Bandura emphasises the role of environment, and in his opinion efficacy expectations can be developed by social learning. Efficacy expectations are based on four important sources of information: „performance accomplishments, vicarious experience, verbal persuasion, and physiological states." [6, p. 195.] Performance accomplishment is an especially important source of efficacy information, because it comes from successful mastery experiences. Vicarious experiences derive from seeing others perform. Verbal persuasion alone has limitations as a means of increasing of personal efficacy, „people who are socially persuaded that they possess the capabilities to master difficult situations and are provided with provisional aids for effective actions are likely to mobilize greater effort than those who receive only the performance aids" [6, p. 198.]. Physiological states, namely emotional arousal is a source of information that affects self-efficacy in coping with threatening situations and in reducing avoidance behaviour. Institutes of education and their training programs form students' perceived competences by shaping the environmental characteristics of learning.

2.2. Perceived quality

Conceptualizing and measuring service quality has been in the forefront of services marketing research, as providing quality service is essential for success in a competitive environment [7]. Nevertheless, service quality is a highly elusive construct, due to features of services such as intangibility, inseparability of production and consumption, heterogeneity and perishability [8]. We must differentiate between perceived quality and satisfaction: while the former is frequently considered to be an overall evaluation of the service, the latter is a transaction-specific and short-term attitude [9].
The work of Parasuraman et al [10] has been highly influential in the measurement of perceives service quality in a wide variety of services. They have captured service quality as a gap between the expectation and perceptions of customers and developed SERVQUAL, a 2*22-item instrument for measuring these. According to them, perceived service quality is a construct of five dimensions:

- tangibles (containing physical facilities and equipment , as well as the appearance of personnel);
- reliability (the ability to provide the promised service accurately);
- responsiveness (willingness to help customers);
- assurance (the courtesy and ability of employees to inspire trust and confidence);
- empathy (caring and individualized attention provided to customers).

However, defining service quality as a gap between expectations and perceptions has received considerable criticism. SERVPERF [11] maintains measuring the above five dimensions, but focuses

on perceived performance, neglecting expectations. Many authors agree that consumers' assessment of continuously provided services depend solely on performance, confirming that SERVPERF results are more reliable, and provide greater explained variance than SERVQUAL [12]. Measuring not only perception but also expectations provide more information for a exploratory research, though. It is not surprising therefore that there has been research using both SERVQUAL and SERVPERF in a higher education setting (see e.g. [3] [12] [13]).

3. Research methodology and early results

Due to the novelty of our research topic and the lack of previous examples, our research methods were improved continuously during the past few years. In 2011, we conducted focus group interviews with students and measured their level of satisfaction with the training courses. The only relevant result of these interviews showed us that students are satisfied with these courses.
In 2012, we conducted a quantitative research: we compiled lists of competences for each training course, based on special literature. We used these lists to measure students' own perceived competencies before and after trainings. We also measured changes in students' self-efficacy with an R. Schwarzer test containing 10 items, and sense of coherence with a 13-item version of Antonovsky's scale [14]. After cleaning the data and putting pre- and post- questionnaires of the same respondents in pairs, fifty students remained in the sample: 19 males and 31 females.
In the 2012 questionnaire study, we had two important results. We measured positive changes on our competence scales, but many of the items were concepts with which the students encountered at the training courses for the first time. So, we decided to modify the lists to measure more common, easy-to-understand competencies in the next year. Our second conclusion is related to the R. Schwarzer and to Antonovsky's test. The result of the self-efficacy scale showed significantly raised points due to the training in the pos-test compared to the pre-test. This is expected because self-efficacy should be higher after a successful training. Sense of coherence scale measures a more stable view of life what didn't change after few days of training. We don't believe our trainings will change participants' life like a magic wand, but if they reach a higher self-efficacy level and gather some competences, they may change more on the long run.
In 2013, we have started to use more simple competence lists and we ask narratives about the trainings' specific topics before and after them. We intend to search for differences in the participants' problem-solving skills in training theme related situations. We measure changes in competences (technical quality) one week after trainings.
This year, we intended to measure functional quality as well. We have developed a SERVQUAL tool (that may be called EDUQUAL) and used it to capture the course-level perceived quality of the courses – to measure students' perceptions about trainings and non-training courses. We have adapted the SERVQUAL approach due to its ability to generate information on not only the evaluations of the actual service, but also about the expectations of students. Compared to the original scale, we have devised a significantly modified version of it, as higher education courses differ significantly from those types of services that were originally measured by the model. Nonetheless, we have managed to preserve the content of the five original dimensions, and have formulated 24 statements to be evaluated on a 5-point Likert scale. In addition, we used 4 items for measuring student satisfaction, including a question about the overall satisfaction of the course.

4. Results

For training evaluations, our sample consists of 156 respondents (of which 41,7% are males and 58,3% are females), divided among 3 types of trainings. For SERVQUAL evaluations, our sample consists of 181 respondents (of which 36,5% are males and and 63,5% are females) for the SERVQUAL questionnaire which was divided among 4 teachers and 12 courses.
Our results about competence changes show that for all trainings, statistically significant ($p \leq 0.05$) improvements can be captures for several competences (Table 1). We found a gender effect: female students have a 0,2 point higher average self-evaluation both before and after trainings than male students (a significant difference in both cases), but the rate of improvement itself is not different for genders.

Table 1: Competences with significant improvement

Training	Competence	Mean of self-evaluations before training	Mean of self-evaluations after training
Team-building	Knowledge of the process of team formation	3,00	3,85
	Knowledge of important team roles	3,32	4,10
	Accepting other people	4,05	4,33
	Being firm	3,69	3,97
	Solving tasks in teams	3,97	4,41
	Expressing emotions in front of others	3,00	3,44
	Arguing for your own opinion in front of others	3,67	4,08
	Talking about yourself in front of others	3,15	3,54
Conflict management	Giving feedback to others	3,58	4,17
	Searching for solutions optimal for everyone	3,73	4,17
	Knowledge of conflict management types	2,15	3,78
	Being calm in a stressful situation	2,78	3,48
	Conducting conflict conversations with a focus on solution	3,76	4,04
	Starting conflict conversations	3,13	3,96
Communication	Building relationships with other people	3,52	3,86
	Making connection with others	3,73	4,11
	Recognising different aspects	3,55	4,08

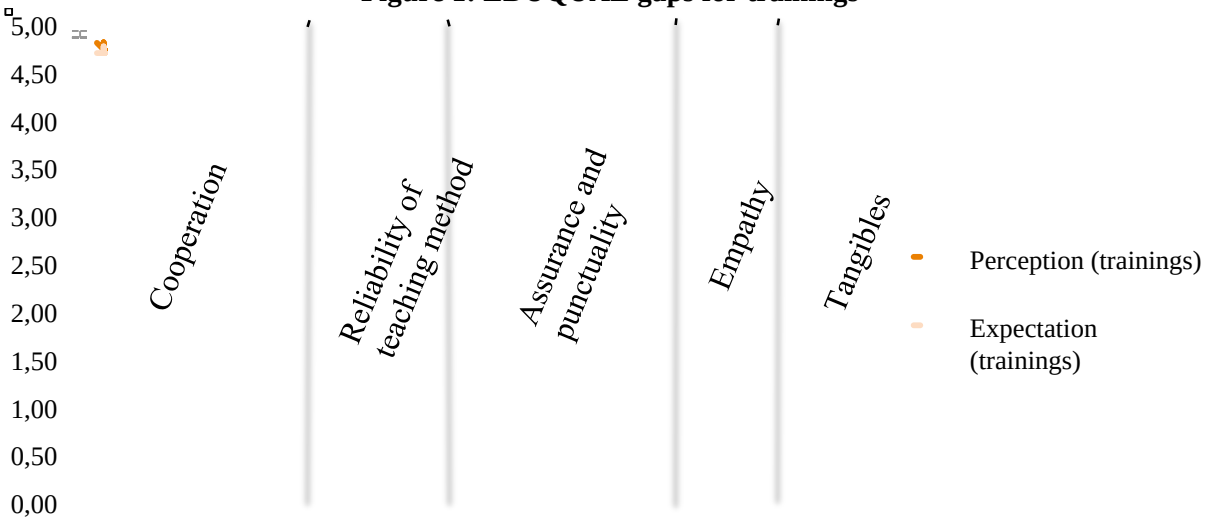
Note: Numbers show the average of respondents' self-evaluations of the given competence on a 5-point scale, where 5 is the best evaluation. The differences between before- and after-evaluations are statistically significant ($p \leq 0.05$).
Source: Own construction

In order to validate our adapted SERVQUAL instrument (EDUQUAL) and to identify dimensions, a factor analysis was carried out to validate the gap scores (perceptions minus expectations for each items). A principal component method and VARIMAX rotation were used. The factors we identified were able to explain approximately 65% of the total variance, which is a good result compared to other ones in this specific field.
The factors identified are the following:

- Cooperation, refering to the atmosphere of the classes and the level of partnership in the relationship between the lecturer and the students.
- Reliability of teaching method, which refers to the way knowledge is trasferred and whether the lecturer takes the students's needs into consideration.
- Assurance and punctuality which refers to an accuracy of the administrative and professional sides of the teaching process.
- Empathy, refering to meeting students' needs.
- Tangibles, refering to the physican environment as well as the appearance of the lecturer.

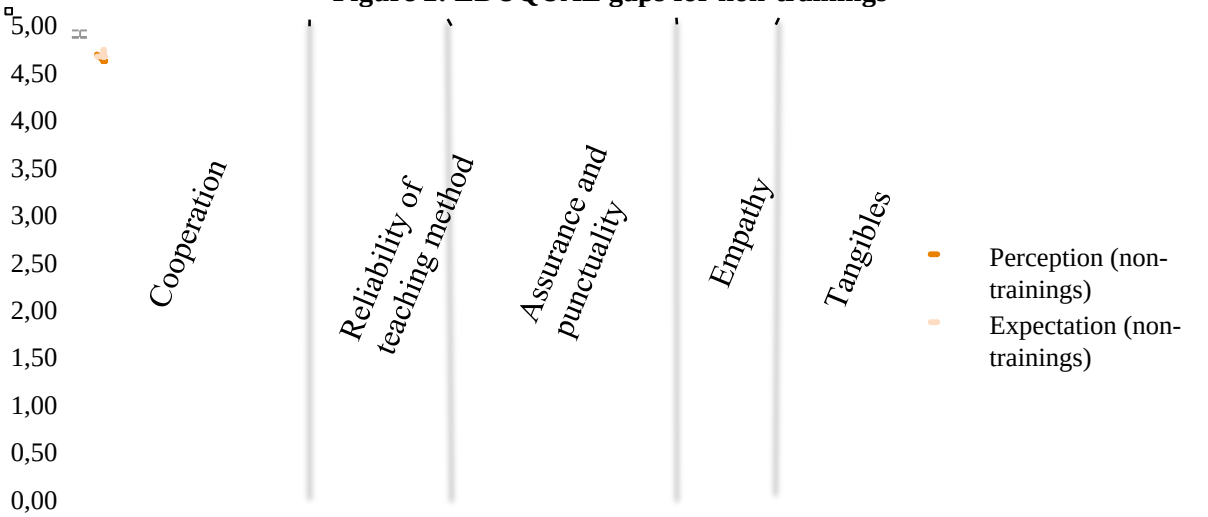
When calculating the gaps between the perceptions and expectation of students (means of evaluations, Figure 1 and 2), we found that there were only marginal gaps, and these were positive at most of the cases, indicating a good quality of service delivery. Ahe results also show that both expectations and perceptions get high ratings. The lowest (compared to the other factors) expectations and evaluations belong to the dimension of tangibles, while other dimensions seem to be equally important.

Figure 1: EDUQUAL gaps for trainings



Source: Own construction

Figure 2: EDUQUAL gaps for non-trainings



Source: Own construction

Our results also showed that there were significant, but moderate correlations between most of the factors and overall satisfaction (Table 2). The exception was the factor of Empathy, which seems to be a little bit problematic – this was the most difficult to give a name to, too. For future research, it will worth consider modifications in the scale.

Table 2: Correlations between perceived quality factors and satisfaction

Factors	Correlation with overall satisfaction
Cooperation	0,464**
Reliability of teaching method	0,475**
Assurance and punctuality	0,473**
Empathy	0,134
Tangibles	0,364**

Note: ** Correlation is significant at the 0.01 level (2-tailed).
Source: Own construction

5. Conclusion

It is not evident how to measure a higher education institution's course-level service quality. With the intention to grab both technical and functional quality, we developed a methodology consisting of measuring the development of competences, as well as student experiences of the process. Our preliminary results show that competence lists of a specific training should carefully be created, as students lack understanding many concepts that are considered to be important in the specific literature. Our research thus continued with modified competence lists, measured before and after trainings to grab changes, and with an adopted version of the SERVQUAL scale. Both methods resulted in well-interpretable results, showing that trainings enable students to improve their competences and also that our scale for measuring the quality of the service delivery process (EDUQUAL) is valid and shows a good functional quality of our courses.

References

[1] Pereira, A., Oliveira, I., Tinoca, L., Amante, L., Jesus Relvas, M., Carmo Teixeira Pinto, M., Moreira, D. (2009): Evaluating continuous assessment quality in competence-based education online: the case of the e-folio. European Journal of Open, Distance and E-Learning 2009/II: http://www.eurodl.org/?p=archives&year=2009&halfyear=2&article=373.
[2] Lelanc, G., Nguyen, N. (1997): Searching for excellence in business education: an exploratory study of customer impressions of service quality.
[3] Cuthbert, P. F. (1996): Managing service quality in HE: is SERVQUAL the answer? Part 1. Managing Service Quality 6/2: 11-16.
[4] Grönroos, C. (1982): A service quality model and its marketing implications. European Journal of Marketing 18/4: 36-44.
[5] Szelestey J. (2013) Kompetencia modell kidolgozásának elméleti háttere. http://www.erg.bme.hu/Szakkepzes/4felev/SelesteyKompetencia.pdf
[6] Bandura, A. (1977): Self-efficacy: Toward a unifying theory of behavioural change. Psychological Review, 84/2: 191-215.
[7] Zeithaml, V. A., Berry, L. L., Parasuraman, A. (1996): The Behavioral Consequences of Service Quality. Journal of Marketing 60/2: 31.46.
[8] Lovelock, C., Gummersson, E. (2004): Whither Services Marketing? In Search for a New Paradigm and Fresh Perspectives. Journal of Service Research 7/1: 20-41.
[9] Athiyaman, A. (1997): Linking student satisfaction and service quality perceptions: the case of university education. European Journal of Marketing 31/7: 528-540.
[10] Parasuraman, A., Zeithaml, V. A., Berry, L. L. (1988): SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality. Journal of Retailing 64/1: 12-40.
[11] Cronin, J. J., Taylor, S. A. (1994): SERVPERF Versus SERVQUAL: Reconciling Performance-Based and Perceptions-Minus-Expectations Measurement of Service Quality. Journal of Marketing 58/1: 125-131.
[12] Abdullah, F. (2006): Measuring service quality in higher education: HEdPERF versus SERVPERF. Marketing Intelligence and Planning 24/1: 31-47.
[13] Cuthbert, P. F. (1996b): Managing service quality in HE: is SERVQUAL the answer? Part 2. Managing Service Quality 6/3: 31-35.
[14] Balajti I., Vokó Z., Ádány R., Kósa K. (2007): A koherencia-érzés mérésére szolgáló rövidített kérdőív és a lelki egészség (GHQ-12) kérdőív magyar nyelvű változatainak validálása. Mentálhigiéné és Pszichoszomatika 8/2: 147-161.

RESPONSIBILITY AND SUSTAINABILITY IN PROJECTS

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Keywords: Responsibility, sustainability, sustainability project management, ISO 26000, ISO 21500, ISO 20151

Abstract: Responsibility and sustainability in projects were shaped by general standards like ISO 26000 [1] on social responsibility or by an extended stakeholder management as described in the 5th edition of PMBOK® [2] of PMI® or in ISO 21500 [3] derived from PMBOK®. The new standard ISO 20151 [4] on sustainable event management and recent initiatives of the International Institute of Sustainability Project Management – IISPM – [5] and others like [6], [8] try a full integration of responsibility and sustainability in project management and open new perspectives for the future.

1. Roots and Classical Standards

Sustainability and responsibility shape human life and are strengthened by the definition of human rights, by the Global Compact and further strategies. Core issues are:

- Balance and integration of the social, economic and environmental components of a community
- Meet the needs of existing and future generations
- Respect the needs of other communities in the wider region or internationally to make their communities sustainable.

ISO 26000 on social responsibilty is a lighthouse on sustainbility and responsibility for all areas. With the growing importance of projects and project management these issues become more and more important in this area. Tracks on responsibility and sustainability in project management are visible in recent standards. ISO 21500 had been derived from PMBOK® of PMI and introduced a new knowledge area on stakeholder management – even before this knowledge area had been defined in the 5th edition of PMBOK®. A stronger focus on stakeholders supports responsibility and sustainability. Corporate social responsibility is by definition is a multi-stakeholder concept.

2. New Standards

ISO 20151 on sustainable event management was derived from the project management experience of the Olympic Games in London. This standard is a prototype for the integration of responsibility and sustainability in project management standards in the future and in further areas.

A new similar approach on a full integration of responsibility and sustainbility in projects is offered by the International Institute of Sustainability Project Management – IISPM – [5]:

"Key Components of the sustainability management processes:

- Model of sustainability management processes across the project lifecycle
- Responsibilities and commitments reflecting the organization's definition of and commitment to sustainability efforts
- Use of a Sustainability Breakdown Structure
- Definitions of sustainability risk probability and impact along with related scales and metrics
- Stakeholders' tolerances related to sustainability risk" [5]

In the book on Social BPM [8] business processes are reshaped to integrate responsibility and sustainability.

3. Full Integration of Responsibility and Sustainability in the Future

The full integration of responsibility and sustainability in all knowledge areas and core processes in project management is necessary and extends the horizon as shown in the figures below.

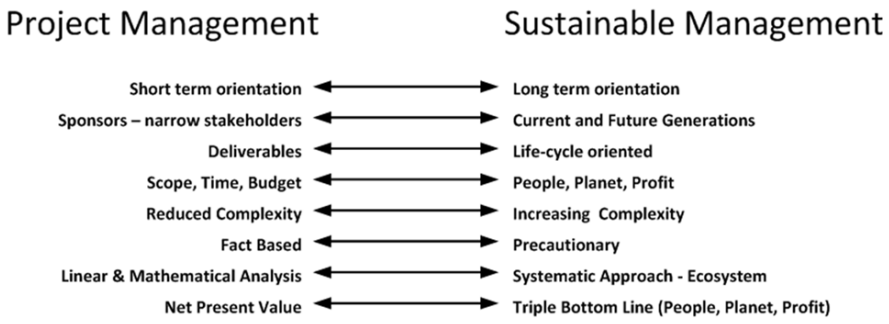

Figure 1: Project Management – Sustainable Project Management

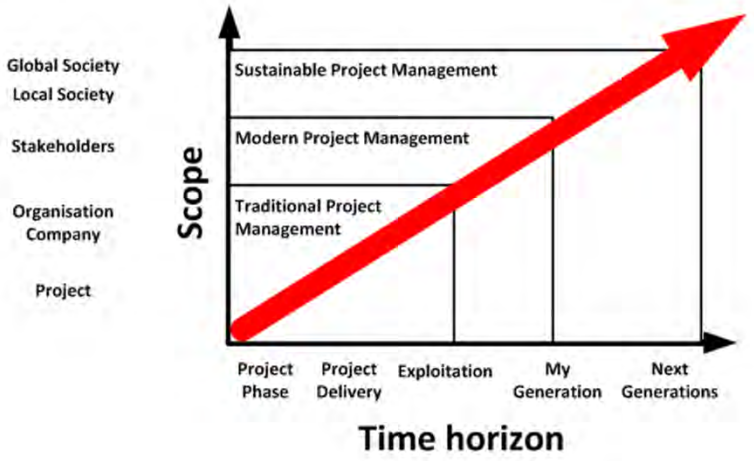

Figure 2: Horizon and Scope of Sustainable Project Management

There are further contributions for selected knowledge areas like [10]. The integration of responsibility and sustainability is also an issue of lean project management [9].

4. References

[1] ISO 26000 Social Responsibility, ISO, (2010)

[2] A Guide to the Project Management Body of Knowledge (PMBOK® Guide), PMI® (2013)

[3] ISO 21500 Guide to Project Management, ISO, (2012)

[4] ISO 20151 Sustainable Event Management, ISO, (2013)

[5] International Institute of Sustainability Project Management - IISPM, http://iispm.org/ , last visited on June 28, (2013)

[6] http://www.sustainable-project-management.org/cms/index.php/en, last visited on June 28 (2013)

[7] http://www.unglobalcompact.org/, last visited on June 28 (2013)

[8] Lyna Fischer (ed.): Social BPM: Work, Planning and Collaboration Under the Impact of Social Technolog, CreateSpace Independent Publishing Platform (2011)

[9] Reusch, Peter J. A.; Reusch, Pascal: How to Develop Lean Project Management?, IDAACS (2013)

[10] Reusch, Peter J. A.; Ojeda, Omarlyn: Sustainable Procurement: Extending Project Procurement Concepts and Processes Based on PMBOK, IDAACS (2013)

How can a socially responsible and sustainable university be created?

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How can a socially responsible and sustainable university be created?
Before answering the question of how a university can be organized in a socially responsible and sustainable manner, I will first attempt to answer the probably more urging question why a university should be turned into a socially responsible and sustainable organization.
Let me first present a definition of "sustainable" which I can agree with.: Sustainability is the ultimate goal or destination. Exactly what defines the state of being, of what is sustainable (whether it be a society, logging, fishing etc), is informed by science but ultimately depends on personal values and world views.
To achieve a state of environmental sustainability, a framework or process is needed. Certain conditions have to be met and steps in the process toward 'sustainability' have to be made. The framework of sustainable development is the means for achieving sustainability.
So, in brief, "sustainability" refers to the goal and "sustainable development" is the path or framework to achieve it. As with the term "sustainability", what is considered as a necessary path and time frame will vary amongst individuals [1] .
The discussion about social responsibility and sustainability for universities is driven by several major trends and developments:
Within the Bologna process aiming at harmonizing and unifying the academic landscape the goal of employability has been defined [2]. The focus on employability is discussed with respect to the consequences for a sustainable development of universities. Topics like commercialization of education and outsourcing of the evaluation of study programs cause increasing criticism.
The Bologna process didn't put enough emphasis on cross-sectoral tasks. Topics like "reducing gender and social inequalities" were included only step by step. Preventive health care was not considered yet despite being suggested several times [3].
The topic of sustainability was promoted by the representatives of the Copernicus Network for Sustainable Universities. It was given new thrust by the Rio follow-up conference during which the decade of sustainable education was proclaimed. In several conferences of UNESCO, the crucial role of universities for the education of future generations was highlighted as well. Regarding the issue of sustainability, alliances even extend into UN organizations.
Meanwhile four international organizations with a strong commitment to making sustainability a major focus of higher education have formed the Global Higher Education for Sustainability Partnership (GHESP). The four founding partners of the initiative – the International Association of Universities, the University Leaders for a Sustainable Future, Copernicus Campus and UNESCO – combine forces in a unique effort to mobilize universities and higher education institutions to support sustainable development in response to Chapter 36 of Agenda 21.

A discussion about the importance of ethics for universities has emerged. In his book "Academic Ethics", Neil Hamilton observes that most doctoral programs fail to teach students about academic ethics so that knowledge in this field is eroding. Lack of emphasis on ethics in graduate programs leads to skepticism about the necessity of learning about ethics and about how to teach it. For these reasons academics generally do not seriously consider how ethics education might be creatively revived. In reaction to the Enron corporate scandal, for instance, some business schools have tacked an ethics courses to an otherwise ethically vacuous M.B.A. program. While a step in the right direction, a single course in a program otherwise uninformed by ethics will do little to change the program's culture, and may even engender cynicism among students [4].

A new understanding of progress and innovation in science has emerged. The North-Rhine-Westphalia Ministry of Science and Technology is promoting a holistic view on academic research. The focus is on the "great challenges of our society" rather than on simple product innovations. Universities are expected to contribute solutions to these challenges.

Based on these developments, the question if a university considers itself socially responsible and refuses to bow to stakeholder interests or subordinate all activities to the care for their students' EMPLOYABILITY has to be discussed. I agree with Dirk Mossmeyer's statement who says, "Using the metaphor of the university as a cultural space, we consequently vest it with authority to influence and form this cultural space in a way that goes far beyond the setting of a curriculum, teaching methods and examination profiles." [5] Mossmeyer has published an variety of research contributions about ethical education at universities, particularly for business studies.

"Universities have long been agents of change – catalysts for social and political action as well as centers of learning. Universities not only educate most of the world's leaders, decision-makers and teachers and advance the boundaries of knowledge, but as major employers and consumers of goods and services they play a significant economic role nationally and globally" [6].
So why should a university in North-Rhine-Westphalia put emphasis on social responsibility and sustainability? The simplest answer seems to be a normative one: Because it is forced by law. But it is not that simple. In the current North-Rhine-Westphalian University Law social responsibility or sustainability is not included. Nevertheless, over more than forty years have contributed to the change process in society. Four representative examples should be named:

1. The process of the fostering equality of men and women and the gender mainstreaming
2. Support for childcare and the transformation into family-fair institutions
3. Support of health care and health promotion
4. The development towards sustainable universities

These developments happened in connection with different social processes taking place more or less successfully at the same time.

1. Women's movement with the statement: "The private is political" [7]
2. Reform of the German constitution in 1994 putting emphasis on the promotion of equality of men and women
3. Gender mainstreaming was introduced into UN and EU processes
4. Managing diversity has become a major topic in business

But how did social responsibility in universities progress during this time? Peter Scott stated: Universities are value-laden institutions - perhaps the most value-laden institutions in the modern society… universities not only express intellectual and scientific values directly through their teaching and research; they also embody powerful organizational values…and equally influential instrumental values… finally, universities contribute crucially to the formation of wider social and cultural values [8].
The Bonn Declaration at the UNESCO WORLD Conference on Education for Sustainable Development, 31 April – 2 May 2009 says: "ESD (Education for Sustainable Development) is based on values of justice, equity, tolerance, sufficiency and responsibility. It promotes gender equality, social cohesion and poverty reduction and emphasizes care, integrity and honesty, as articulated in the Earth Charter. ESD is underpinned by principles that support sustainable living, democracy and human well-being. Environmental protection and restoration, natural resource conservation and sustainable use, addressing unsustainable production and consumption patterns, and the creation of just and peaceful societies are also important principles underpinning ESD. " [9]
While the UN decade for ESD promoted the involvement of sustainability aspects into curricula, the education for health promotion is still insufficient. The European agency for health and safety OSHA has demanded the introduction of the topic into curricula [10]. A self-assessment tool was developed and incentive systems have been proposed by Michel [11].
There is a demand for an integrated management system for this kind of cross-sectorial tasks. A crucial factor for a successful change process within the university is the commitment and support of the rectorate or board of the university. With a board decision, the change process is released and the supporters of change have a chance to establish a path towards a sustainable and socially responsible university. The decision to move towards a change process is pushed either by the board of the university as an active process of by force of the legislation and ministry as a reactive process.
ISO 26000 as a respective management system [12] describes how to implement the change process towards sustainability and social responsibility. It can be applied to universities, too.

The UNEP Toolkit for the Greening Universities shows the barriers for implementing the change process [13,14]: "Strategies for organizational change are often characterized as top down (management driven) or bottom up (staff driven). The best strategies usually involve a combination of both approaches; for example, adoption of a high level vision statement or policy, and initiation of low cost, high impact project(s) at a grass roots level. Improving energy efficiency is a typical example of such "low hanging fruit". Experience worldwide has demonstrated time and again that leadership from university management at the highest level is essential to integrate sustainability into mainstream practice. Bottom-up action by staff and students is necessary, but is not in itself sufficient to bring about inclusion of sustainability in the university's core business." [15].

References:

[1] Harding, R., (1998) ed. Environmental Decision-making. The roles of scientists, engineers and the public. 1998, Federation Press: Sydney.

[2] Parlamentarische Materialien: Nationalrat, XXIV.GP Stenographisches Protokoll44. Sitzung

[3] Dooris, Mark (2001) "The “Health Promoting University”: a critical exploration of theory and practice", Health Education, Vol. 101

[4] De Russy, C. ans Mitchell Langbert (2005): The Corrosion of Ethics in Higher Education

[5] Dirk C. Moosmayer, (2012)A Model of Management Academics' Intentions to Influence Values ACAD MANAG LEARN EDU June 2012

[6] U.N.E.P. Greening Universities Toolkit

[7] Klaus, Elisabeth; Drücke, Ricarda (2008): Öffentlichkeit und Privatheit: Frauenöffentlichkeiten und feministische Öffentlichkeiten In: Becker, Ruth; Kortendieck, Beate: Handbuch Frauen- und Geschlechterforschung 2008

[8] Scott, Peter (2004): Ethics ìn ` and `for` Higher Education, Higher Education in Europe, Volume: XXIX, No. 4, December 2004

[9] http://www.esd-world-conference-2009.org/fileadmin/download/ESD2009_BonnDeclaration080409.pdf

[10] Mainstreaming occupational safety and health into university education, European Agency for Safety and health at Work, ISSN 1830-5954

[11] Michel, S.: (2006) Anreize für ein Qualitätsmanagement von Gesundheitsförderung und Nachhaltigkeit an Hochschulen und wissenschaftlichen Einrichtungen. In: Faller, Gudrun, Schnabel, Peter-Ernst (Hg.): Wege zur gesunden Hochschule, Ein Leitfaden für die Praxis, Berlin, 2006

[12] Hahn, Rüdiger Standardizing Social Responsibility? New Perspecives on Guidence Documents and Management System Standards for Sustainable Development, TEEE, Tansactions for Engineering Management (DOI 10.1109 TEM 2012.2183639)

[13] Thaman, K., Shifting sights: The cultural challenge of sustainability. International Journal of Sustainability in Higher Education, 2002

[14] Bekessy, S., K. Samson, and R.E. Clarkson, The failure of non-binding declarations to achieve university sustainability: A need for accountability. International Journal of Sustainability in Higher Education, 2007

[15] Greening University Tolkit a.a.O p.

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